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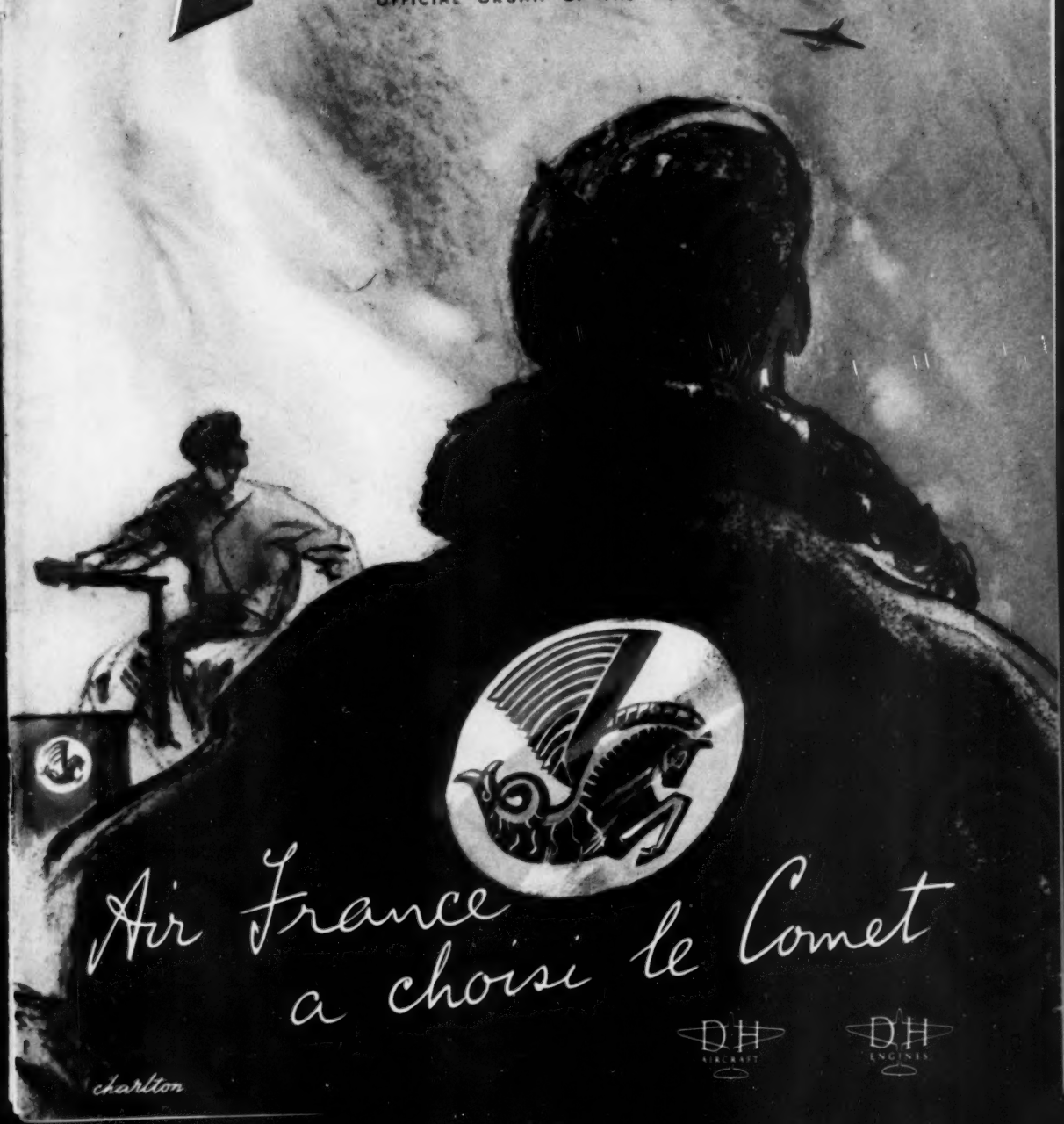

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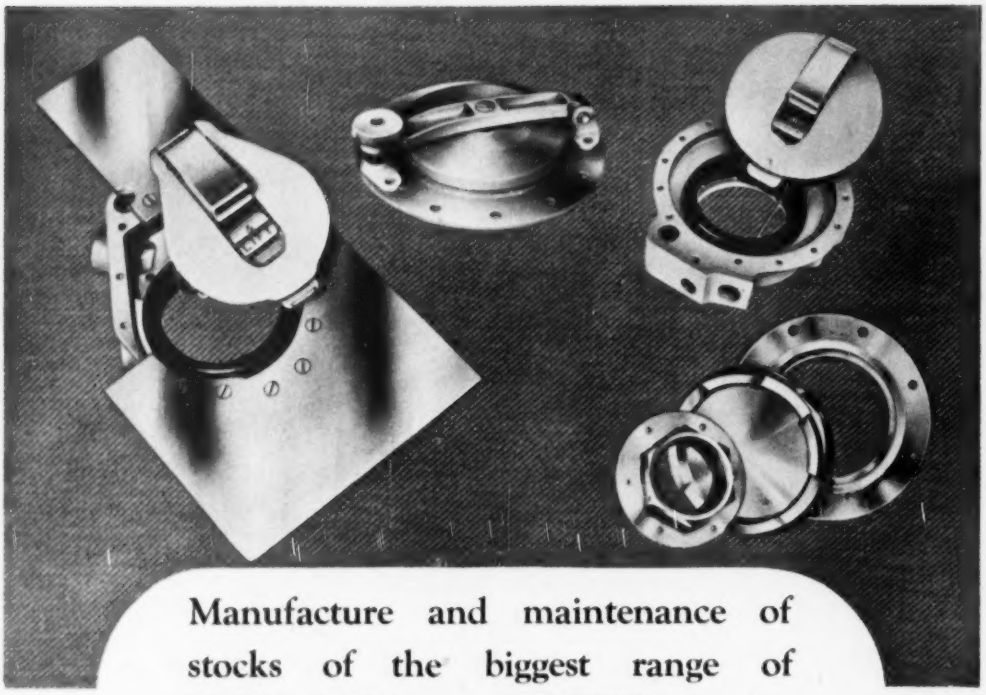

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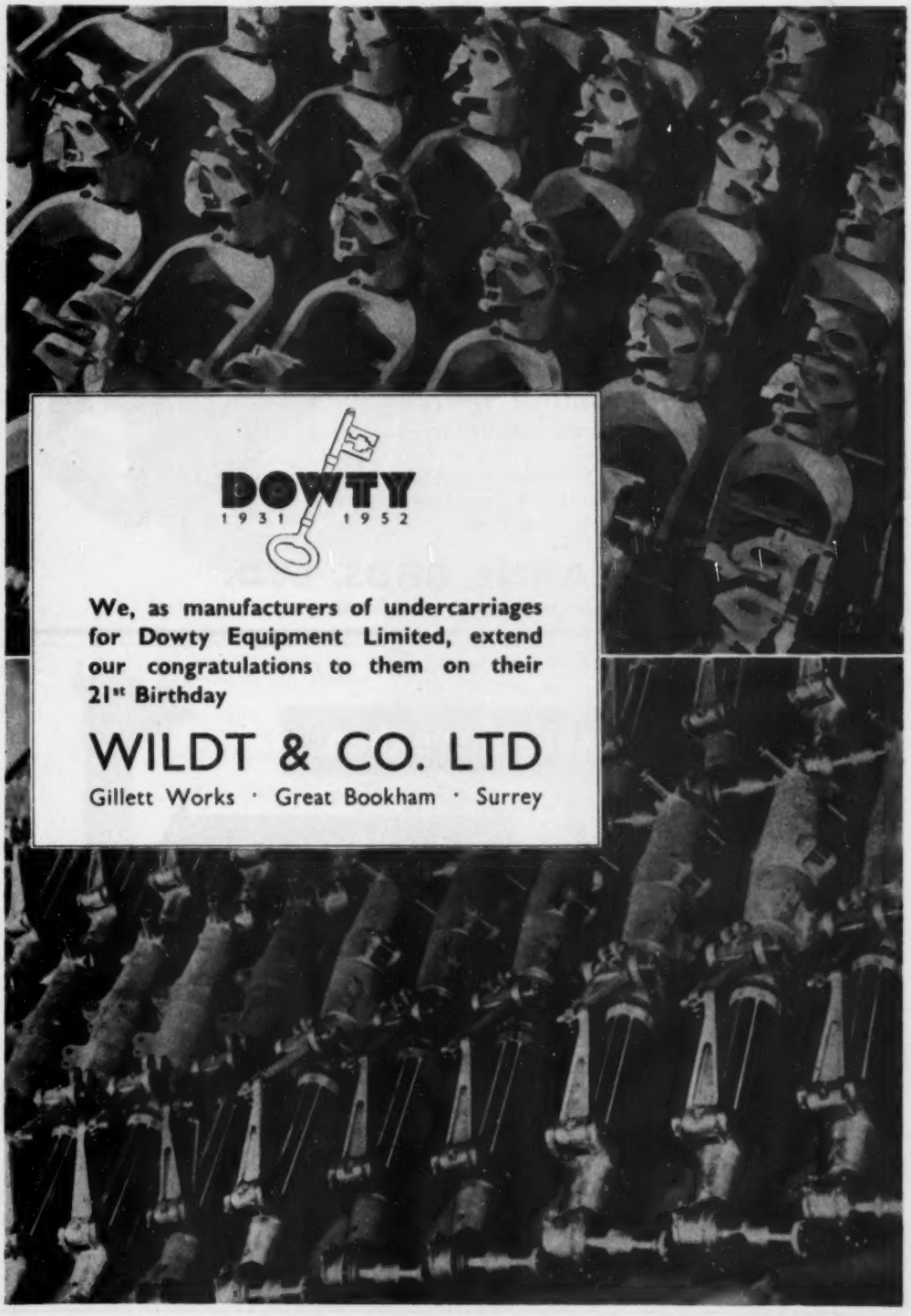
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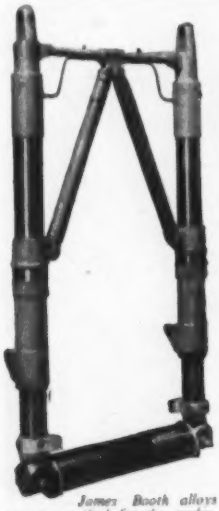

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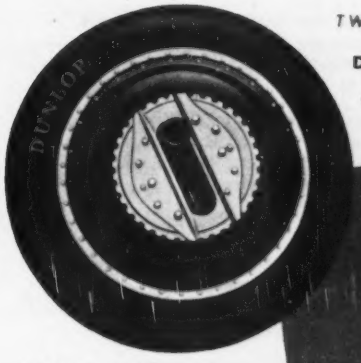

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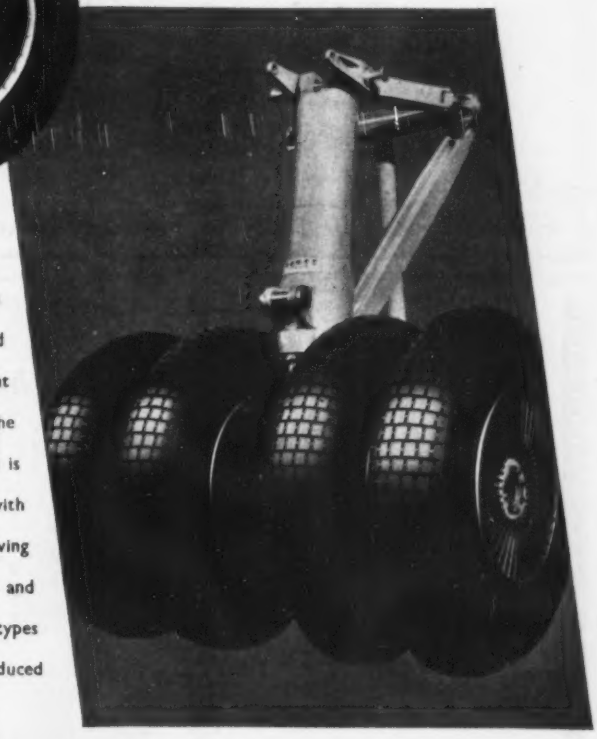

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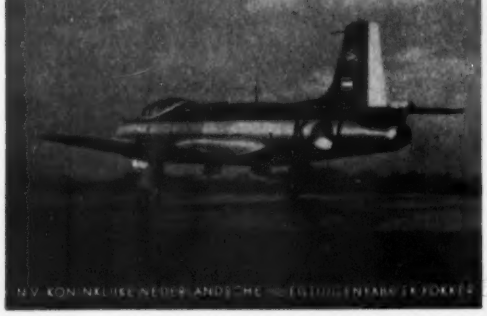

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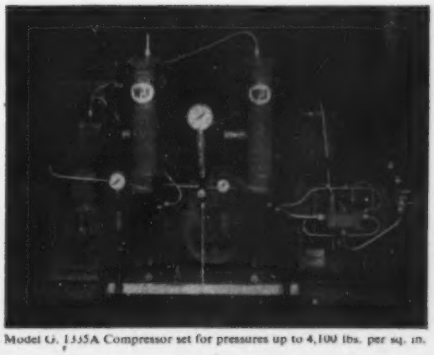

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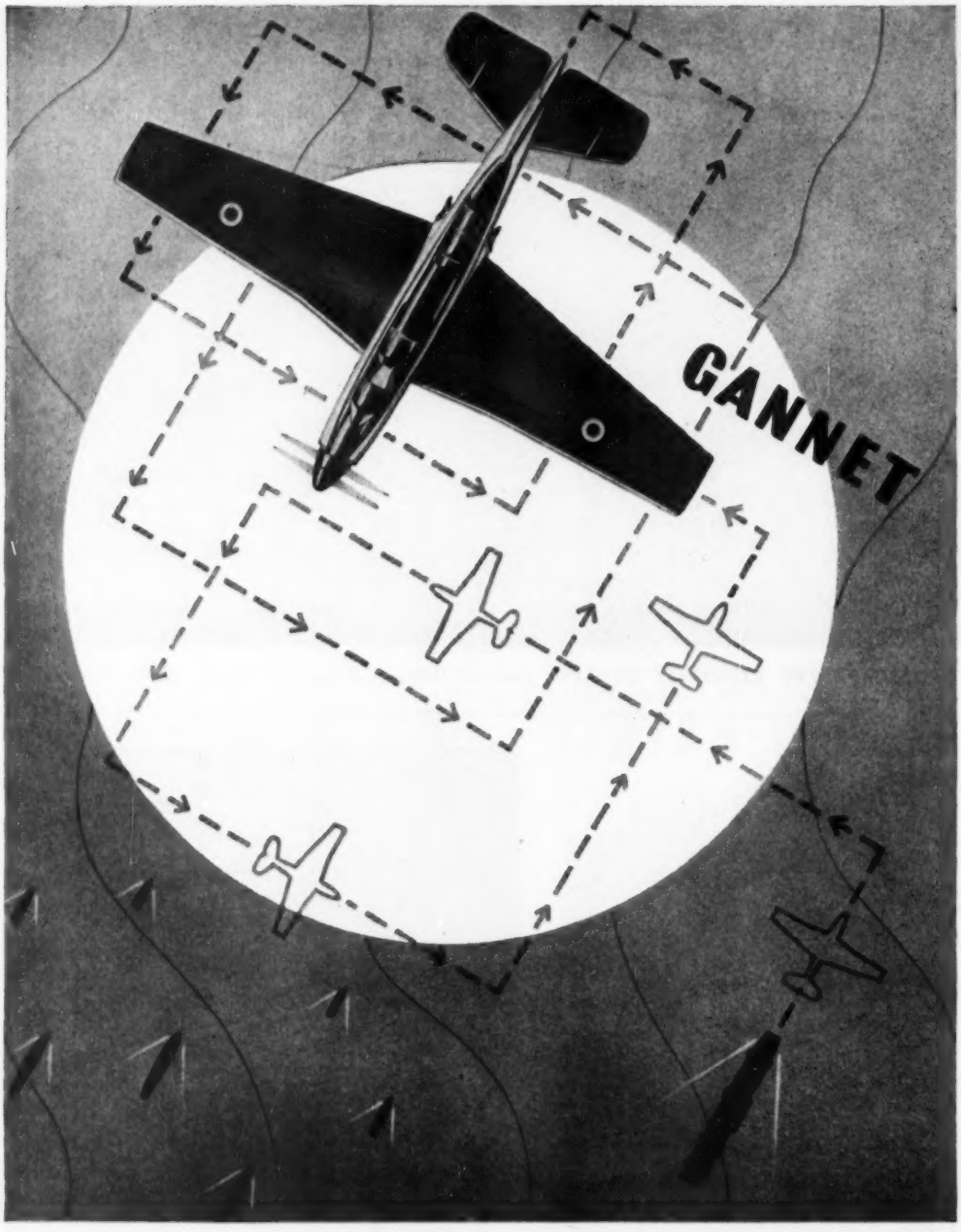

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First Aeronautical Weekly in the World

Founded 1909

No. 2262 Vol. LXI. FRIDAY, 30 MAY 1952

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Majesty and History

WE are often reminded that the reigning Queen belongs to a very air-minded family. The active and much-valued interest which she herself has shown in many aspects of British aviation is shared by the entire Royal Household—as events of the past few days have shown. A week ago the Queen Mother and Princess Margaret flew in a Comet at speeds and altitudes which until lately were phenomenal. Now the report gains currency that the Duke of Edinburgh intends to qualify for pilots' wings (an intention which, we respectfully venture to suggest, might appropriately be realized at the Central Flying School—a unit which is surely above inter-Service rivalry). Royal support of this kind, far beyond the calls of State duty, is too often taken for granted; it gives cause for proud gratification.

It seems timely to reproduce here a passage from *Flight* of 25 years ago, almost to the day, dealing with the visit to Buckingham Palace of the young American who had just made the first solo crossing of the Atlantic. As the pilot left the Palace, where King George V had invested him with the Air Force Cross, "the little Princess Elizabeth waved her hand to him, whereupon Lindbergh went up, shook hands and patted her cheek." That was 25 years ago—only yesterday by history-book standards. Yet since then the lonely path of the transatlantic pioneers has become a broad highway travelled by 1,500,000 airline passengers—among them the Princess who became Queen Elizabeth II.

Parting of the Ways

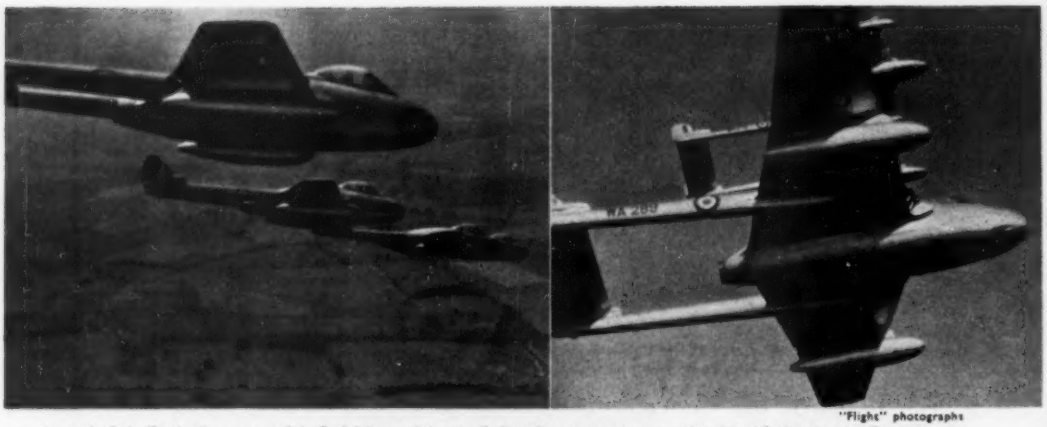
SIR HARRY GARNER, Chief Scientist, Ministry of Supply, touched upon a diversity of engaging subjects in the fortieth Wilbur Wright Memorial Lecture, a digest of which appears in this issue; and of these none commands more interest at this time than the prospects for civil aircraft.

It is clear, as Sir Harry remarks, that operational economy and passenger comfort are likely to dictate cruising speeds below Mach 1 for many years to come, whereas military requirements are such that the focus has already switched almost completely from the problems of subsonic flight to those imposed by the supersonic regime. Thus, in Sir Harry's opinion, the people responsible for developing civil aircraft will no longer be able to rely, as in the past, on "crumbs that fall from the rich military man's table": if civil aircraft are to improve they will do so only if their importance in their own right is recognized, and if research and development programmes adequate for their needs are put in hand.

Nor is the divergence of civil from military practice a matter of speed alone: the problem of range is an almost equally vexed one. According to Sir Harry, there are many people who believe that there would be an important use for aircraft with a range of 12,000 miles. "The job of the scientist and engineer," he says, "is to look into the possibility of designing such aircraft, and that of the aircraft designer to produce them to meet the demand or, as has happened so often in the past, to anticipate it."

It is the vital need for this pre-vision that we would stress here—a need to which we may easily be blinded by the Comet's flashing brilliance and other bright portents in our immediate ken. Already, as we know from Mr. Arthur E. Raymond, of the Douglas Aircraft Company (*Flight*, May 16th), Britain's rivals in the jet-transport field are gazing deep into "the bouncing crystal ball"; and that, like Sir Harry Garner, they have seen the imminent divergence of the military and civil ways is suggested by a vision described by Mr. Raymond—a large multi-purpose civil transport capable of being fitted into the trans-oceanic, medium and short-range operational pattern, with short take-off and landing distances (at least when carrying moderate fuel loads), adaptable to all kinds of payload and to more than one make of engine, and possessing all reasonable possibilities for growth. . . .

Such a Utopian conveyance could hardly be fashioned from crumbs that fall from even the richest military man's table.



"Flight" photographs

Journey's End : The leading section of the final delivery of Vampire 5s from Singapore arrives over Abingdon airfield and peels off to port.

FAR-EASTERN DELIVERY

Transport Command Ferry Unit Completes Movement of Jets to F.E.A.F.

THE most ambitious jet-aircraft ferrying task yet undertaken by the R.A.F. was completed on Thursday of last week, when a final batch of eight D.H. Vampire 5s completed their 8,680-mile journey from Singapore to Abingdon, Oxfordshire.

This ferrying operation, which started on December 31st, 1951, had as its object the replacement of 41 Mark 5 fighter/bomber Vampires by 44 of the Mark 9 variant. The Vampire had been in service in Malaya for just over a year when it was decided to replace the earlier models by the Mark 9, which is similar in all respects with the exception of a refrigeration unit provided to alleviate cockpit-overheating while operating under tropical conditions.

No. 1 Overseas Ferry Unit of Transport Command, under the command of W/C. E. C. Badcoe, D.F.C., was given the flying to do. All the aircraft except one—which was damaged in an accident—arrived to schedule, and the Chief of the Air Staff sent a signal of congratulation when the final batch of Nines reached Singapore.

The route from Abingdon to Singapore was flown in 18 stages : Dijon—Istres (Marseilles)—Tunis—Castel Benito (Tripoli) — El Adem — Fayid — Habbaniya — Shaibah — Sharjah—Mauripur (Karachi)—Jodhpur—Palam (Delhi)—Cawnpore — Barrackpore (Calcutta) — Mingaladon — Don Muang (Bangkok)—Butterworth—Seletar (Singapore). As far as Karachi the Vampires flew in pairs or in fours, but from then onwards, having left the main route, they assembled into convoys of six. The first two convoys were joined at Calcutta by a Mosquito, which acted as a navigational escort, though subsequently this was found to be unnecessary. Spares and servicing personnel, from Karachi onwards, were carried in Valettas and Dakotas. Generally speaking, the stages were all comfortably within the fuel range of the Vampires, but difficulties did occasionally arise. One such incident occurred when F/S. McCormack was bringing a Mk 5 from Palam (Delhi) to Mauripur (Karachi). The Indian meteorological section had forecast a head-wind of 40 kt—60 kt less than its actual strength. By careful nursing McCormack stretched his fuel to last 2 hr 45 min, some 30 min longer than the safe limit. This, of course, was an exceptional case. The pilots were all enthusiastic over the services rendered to them along the route, the French, Indians and Pakistanis being particularly good.

As would be expected there was more trouble on the homeward route, because the Mk 5 Vampires had already done over twelve months' operational flying against the bandits in Malaya. These last eight aircraft had been nearly a month on the journey. All the hold-ups occurred while the convoy was off the main route and, therefore, it was thought wise for the remainder to wait until repairs were completed. The splitting of fuel tanks was the most serious trouble. Curiously enough, every case occurred while the aircraft was on the ground; one Vampire had no fewer than four tanks fitted.

Although this Malayan Vampire replacement has been perhaps the most spectacular

Against a background of Vampires ferried from the Far East are (left to right) F/S. A. Pugh, F/S. W. Stokes, F/S. S. Warren, F/S. L. J. Wilcox (behind), S/L. T. Stevenson, A.F.C. (O.C. Operational Flight), F/S. W. J. McCormack, F/L. H. M. Deffee, F/O. J. F. Walters and F/O. W. F. E. St. Clair (Convoy Leader).

"Flight" photograph

task in hand, there are many other ferrying operations in progress. Other United Kingdom - F.E.A.F. flights include the delivery of D.H. Hornets to replace the Brigands in Malaya. The Hornets fly down from Mauripur direct to Ceylon and thence direct to Singapore. These last two legs are 1,536 and 1,862 miles respectively and entail flying for four to five hours in an aircraft with no automatic pilot. The Brigands are brought back over the shorter stages of the northern route and are delivered for further service in the Middle East. Vickers Valettas have also been flown out to replace the Dakotas in the F.E.A.F. transport squadrons. For the Middle East Air Force Vampire 9s are also being flown out to replace the Mk 5s. Mosquito night fighters are being delivered, as are P.R.10 Meteors to replace the P.R. Mosquitoes, some of which are returning to Britain.

Another Mosquito-ferrying task is the delivery of a large number of various marks to Yugoslavia. These fly *via* Linz, in Austria, to Zagreb or Belgrade in convoys of six to nine, escorted by a Valetta which returns with the aircrews. These deliveries require very accurate navigation, as the route lies close to Russian, Rumanian and Hungarian territory.

A rather more leisurely job is the bringing back of a number of well-worn Ansons from the Air Navigation School in Rhodesia. Anything from ten days upwards is allowed for the journey back to Britain.

For a pilot to qualify to join a Transport Command ferry unit—and from June 1st all ferrying, both home and overseas, will be in the hands of Transport Command—he must have at least 400 hours in his log-book. A White Ticket is admissible, though one White Ticket pilot in a formation lowers the standard of the whole formation to white.

New pilots must obtain the Transport Command ferry qualification, which takes three to four weeks to secure. They are first given a flying test on a basic type of aircraft—Harvard or Valetta—the test including a general flying check, asymmetric and night flying and basic instrument-flying. Ground subjects on which tests are also given include meteorology, rescue and survival, air-traffic control, pilot navigation, radio aids, ferry-route procedure and general aircraft instruction. A marking of 70 per cent plus is required. In addition, a technical examination must be passed, as ferry pilots must be capable of doing routine daily servicing of their aircraft.

An interesting safety precaution is the requirement that, before leaving on an overseas ferry flight, each pilot must fly his aircraft type for five hours if it is piston engined or three hours if it is a jet. Normally this flying is done at the Maintenance Unit on the actual aircraft the pilot will fly.

FROM ALL QUARTERS

The National Air Races

FORTY-THREE entries have been received by the Royal Aero Club for the National Air Races, which are to be flown from Newcastle-upon-Tyne Airport on July 11th and 12th

Certain changes have been made in the regulations. The most important is that the Air League Challenge Cup will not now be competed for in a race of that name : instead, it will be awarded, with £100 of prize money, to the competitor achieving the fastest lap speed during the whole meeting. Aircraft originally entered for the Air League Race will now fly in the Kemsley Trophy event.

On the first day of the meeting there will be three races, for the Grosvenor Challenge Cup (aircraft up to 1,653 lb), the Norton-Griffiths Challenge Trophy (1,654 lb-2,205 lb), and the Kemsley Challenge Trophy (over 2,205 lb). All three are international contests (though support from abroad is poor this year) and will also, in effect, form eliminating heats for the King's Cup Race on the following day. This event, as usual, is confined to British competitors, and its entry will consist of the first four such competitors to finish in each of the three races in the previous day, plus (or including) the four fastest aircraft in each of those events.

We shall publish full details of the entries at a later date. Meanwhile, the pilots and aircraft constituting the 43 entries for the first day's races are as follows :—

Grosvenor Challenge Cup Race.—R. J. D. Hamilton (Moth), G. F. K. Donaldson (Globe Swift), H. M. Kendall (Chilton DW.1), D. F. Ogilvy (Club Cadet), C. Gregory (Taylorcraft Plus D), P. B. Cash (Autocrat), D. D. Dempster (Chilton DW.1a), D. R. Robertson (Moth Minor), T. W. Hayhow (Tiger Moth), P. W. E. Heppell (Tiger Moth), K. C. Millican (Autocrat), N. F. Duke (Hawker Tomtit), B. J. Snook (Tiger Moth), J. M. Donald (Tiger Moth), A. W. Bedford (Miles Whitney Straight), C. G. Alington (Comper Swift), W. P. I. Fillingham (Chipmunk), L. S. Loveridge (Hawk Trainer).

Norton-Griffiths Challenge Trophy Race.—G. A. Farley (Autocar), T. W. Hayhow (Aiglet), R. Matthews-Naper (Messenger), W. P. Bowles (Messenger), A. R. Moore (Whitney Straight), D. J. Jemmett (Hawk Trainer), J. H. Christie (Leopard Moth), M. R. T. Chandler (Hawk Trainer), F. Dunkerley (Mercury), J. Rush (Falcon Six), R. R. Paine (Hawk Speed Six).

Kemsley Challenge Trophy Race.—G. C. Marler (Falcon Six), S. B. Oliver (Proctor V), T. G. Knox (Proctor I), J. de M. Severne (Vega Gull), P. G. Lawrence (Proctor I) C. F. Hughesdon (Proctor I), D. J. Bennett (Proctor V), H. Wood (Proctor V), W. I. Lashbrook (Proctor III) J. N. Somers (Gemini III), F. Bullen (Hart), G. A. Ferrari (Ambrosini Supersette), F. Dunkerley (Gemini Ia), G. C. J. Cunningham or J. W Wilson (Vampire 5).

Birthday Party

A COUNTRY mansion set in Arcadian beauty; a beaming sun in a cobalt heaven; tablecloths—fluttered by the breeze that rippled a lake where swans floated —laid in a shady marquee which vied with them in whiteness . . .

That was Arle Court, Cheltenham, as we saw it last Thursday, when we were to lunch there with Mr. George Dowty to celebrate his company's attainment of its majority. And into this delectable setting came luminaries of aviation—all smiling.

"The Firm" was proposed by Sir Archibald Rowlands, G.C.B., M.B.E., Permanent Secretary, Ministry of Supply, who, representing himself as the "chief customer," conveyed his felicitations with customary breeziness.

In his response Mr. George Dowty recalled the deeds which we chronicle on other pages, and paid tribute to famous aircraft designers—Messrs. Camm, Carter, Davenport and Hagg, all of whom were seated around him—and Mr. H. P. Folland, who was responsible for the decision to adopt Dowty undercarriages on the Gauntlet and Gladiator. Acknowledging the encouragement given by Gloster director Mr. Hugh Burroughes, he disclosed that Mr. Burroughes is to be the next president of the S.B.A.C.

Mr. Dowty paid particular tribute to his colleague Mr. Rowland Bound for the heavy burden he had shouldered during the early war years, and he did not forget the Government departments and local offices who, 17 years ago, permitted the company to establish its business at Arle Court. To this co-operation he attributed "the complete absence of labour troubles."

Mr. Bound's reply was punctuated by Meteoric thunderings above the marquee, and—having heard the Mayor of Cheltenham pay graceful tribute to the gratitude and admiration entertained by the people of Cheltenham for Mr. Dowty's "wisdom, courage and foresight"—the guests rose and walked out into the sunlight to watch the gyrations of F/L. Gordon of the C.F.S. in a Meteor 7. F/L. Gordon paid his respects to Mr. Dowty by lowering the Meteor's undercarriage as he passed over the buildings where—like many others of like reputation—it was developed.

Canadair's Parent Changes Name

STOCKHOLDERS of the Electric Boat Co. have voted in favour of changing that name to "General Dynamics Corporation." The old title was adopted in 1899 when this big American company was founded as successor to three constituent concerns, the Holland Torpedo Boat Co., who developed the world's first practical submarine, Electro-Dynamic Corporation, makers of electric motors and generators, and the Electric Launch Co.

"The first submarine was electrically driven—hence the name, 'Electric Boat'," explained John Jay Hopkins, chairman and president. "This name no longer adequately describes the nature and scope of a large segment of the business."

The company, he pointed out, is not only a builder of submarines, but also, in its Canadian subsidiary, Canadair, Ltd., in Montreal, possesses an aircraft manufacturing organization with a distinguished record of accomplishment in point of on-time delivery and quantity and quality of production.

The company is also a leading producer of special-purpose generators, while, through a recently organized subsidiary, the General Atomic Corporation, it is ready to engage in industrial applications of atomic energy.

"The company," continued Mr. Hopkins, "is, or soon will be, engaged in engineering and manufacturing activities in which are applied practically every phase of the science of the dynamics : hydrodynamics and thermodynamics at the Electric Boat

FROM ALL QUARTERS . . .

submarine plant at Groton, Connecticut, aerodynamics at the Montreal aircraft plant, electrodynamics at the Bayonne plant—and, to coin a word indicating power from nuclear energy, 'nucleodynamics' as a possible future activity.

"It is thus clear that the broad name General Dynamics Corporation encompasses all current activities, and can include practically any field into which the company may find it logical to enter in the future."

Guided-Rocket Conference

OPENING a two-day conference on guided rockets, held at Ashorne Hill, near Leamington, last Saturday, Mr. Duncan Sandys, Minister of Supply, said that remarkable progress had already been achieved, but there was still much work to be done and time was precious. The advent of the guided rocket would add appreciably to our security and the contribution we could make to the defence of peace.

Valiant Derivatives

IN a detailed review circulated to shareholders before the 85th annual general meeting of Vickers, Ltd. (held on May 23rd), Lt.-Gen. Sir Ronald M. Weeks, K.C.B., C.B.E., D.S.O., M.C. T.D., the chairman, reported that throughout the year the Weybridge and Supermarine works had been building up their output to meet the heavy demands of the rearmament programme. At both works the main problem had been the difficulty of obtaining the requisite labour, and the supply of materials, especially steel, had also caused anxiety.

Due to the demands of the rearmament programme, the Viscount production rate, said Sir Ronald, could only be small, and the orders already received brought delivery dates for further aircraft to 1955. He was hopeful, however, that, when the rearmament programme permitted an increased rate of production, substantial orders might still be obtainable.

He went on to remark that the performance of the Valiant long-range bomber was so outstanding that General Vandenberg and other high-ranking officers of the U.S.A.F. had shown great interest in it. As a result of the Valiant's success Weybridge had been entrusted with the design and development of other important aircraft deriving from it, in addition to work on more than one form of guided missile.

The Mechanical Handling Exhibition

NO executive of the aircraft industry whose responsibilities come within the sphere of improving production should fail to visit an industrial show which opens in London next week. It is the Mechanical Handling Exhibition and Convention, at which—in the two main halls at Olympia—will be concentrated a larger display of mechanized materials-handling equipment than has ever previously been shown anywhere in the world. In addition, papers which will be read by specialists at the Convention will deal with every aspect of the application of mechanical handling to production today. The Minister of Labour and National Service will perform the opening ceremony.

Of particular interest to the aircraft industry will be mobile cranes, power-driven trucks (of both conventional and fork-lift types) and tractors; some 40 of the 180-odd exhibitors will show products of this kind, and many more makers will display hoists, conveyors and allied factory equipment.

Convention sessions will be held on each day of the Exhibition. Among the titles of the papers which will be read are *Materials Handling and the Production Engineer; Mechanical Aids in Industry* (equipment for the smaller works); *The Versatility of Industrial Trucks;* and *Foundry Mechanization.*

The exhibition opens on Wednesday next, June 4th, and continues (the Sunday excepted) until Saturday, the 14th, from 10 a.m. to 6 p.m. daily. Trade visitors are admitted free, provided prior application is made to the organizers, *Mechanical Handling*, Dorset House, Stamford Street, London, S.E.1. Admission price for members of the general public is 2s. 6d.

High Duty Alloys Appointment

FROM the Hawker Siddeley Group comes the announcement that Mr. H. G. Herrington has been appointed managing director of High Duty Alloys, Slough, Bucks. Mr. Herrington was born in Coventry in 1900 and trained in engineering at Coventry Ordnance Works between 1914 and 1918. Later he served in the machine shops of B.T.H. and Coventry Premier. He joined the Sterling Metals Iron and Aluminium Foundries in 1922 and, after serving for a period as assistant to the works manager, he became chief salesman, London district, in 1923.

He joined High Duty Alloys and in 1930 was made general manager; he was appointed a director of the company in 1937. He is also on the boards of Aluminium Wire and Cable Co., Ltd., Northern Steel Scaffolding and Engineering Co., Ltd., Templewood Engineering Co., Ltd., and Société des Alliages Legers de Haute Resistance. He is president of the A.D.A. council

Mr. H. G. Herrington (see above). Col. R. T. L. Rogers (see below).

Air Survey Post

THE Air Survey Co., Ltd.—an associate of the Fairey Aviation Co., Ltd.—announces that Col. R. T. L. Rogers, R.E., has been appointed managing director of its subsidiary Air Survey Co., of India, based at Dum Dum, Calcutta.

Col. Rogers, a Canadian by birth, was commissioned in the Royal Engineers in 1931. After taking the Royal Engineer's young officers' course in engineering at Cambridge he obtained his engineering degree in 1934, subsequently taking an M.A.

He served in Egypt and Palestine in 1935-36 and was posted to the Survey of India in 1938. During the war he served with Indian and British Corps Field Survey Companies in the Middle East, and was subsequently on the survey staff of Allied Forces, S.E.A.C. At the end of the war, he was sent to Indo-China on a Japanese Control Commission, from which he returned to duty with the Survey of India.

AT GLOSTER'S Moreton Valence airfield, on May 23rd, Lord De L'Isle and Dudley, Secretary of State for Air, saw the G.A.5 demonstrated by S/L. Waterton. L. to R.: W. Yardley; S/L. W. Waterton; D. Humphreys, Assistant Private Secretary to the S. of S. (partly obscured); J. Larrard; A.V-M. G. Tuttle, C.B., O.B.E., D.F.C., Asst. Chief of Air Staff (Operational Requirements); S/L. Pendred, Personal Air Secretary to the S. of S.; H. Burroughes; the Secretary of State; F. Sanders; T. O. M. Sopwith, and Eric Greenwood.

ROYAL PASSENGERS in the COMET

A SIGNAL honour was accorded last Friday to the de Havilland Aircraft Company and B.O.A.C.—and, indeed, to all connected with the design, construction and development of the Comet—when the Queen Mother, accompanied by Princess Margaret, enjoyed a 1,850-mile flight in an aircraft of this type. The machine concerned was G-ALYR, now the property of B.O.A.C. and placed at the disposal of de Havillands for the occasion.

The Royal party drove to the Hatfield works, where they were received by Sir Geoffrey de Havilland and then spent three-quarters of an hour in various departments of the factory.

They then went out to the airfield and entered the Comet, which was piloted by G/C. John Cunningham, with Peter Bugge as second pilot. Airborne at 12.25 p.m., the aircraft headed south in a cloudless sky across London, making for Dijon and the Swiss Alps. On reaching Turin it turned westward and flew along the south coast of France, then above the northern foothills of the Pyrenees, and so out across the Normandy beaches to the Channel. The English coast was re-crossed near Brighton, and the Comet then continued northward over London, to touch down at 4.25 p.m. —four hours in the air and 1,850 statute miles covered, representing an average speed of about 463 m.p.h. A speed of 520 m.p.h. was touched on the let-down from 40,000ft, the altitude maintained during most of the flight.

The Royal passengers enjoyed lunch and tea in the air. On the return, Her Majesty made an observation which might well be said to sum up British post-war airliner progress. The Comet, she remarked, was "a lot faster than the aircraft of the King's Flight." On landing, she was presented with a bouquet by Sir Geoffrey de Havilland's grand-daughter Anne.

Also on board the Comet during the flight were the Marquis and Marchioness of Salisbury, A. Cdre. E. H. Fielden (Captain of the King's Flight), G/C. Peter Townsend (Air Equerry), Sir Geoffrey and Lady de Havilland, Sir Miles Thomas (B.O.A.C.'s chairman) and Mr. F. E. N. St. Barbe (D.H. sales director). By a kindly thought on the part of the Queen Mother, also, Her Majesty's chauffeur was invited on board for the trip; he hurriedly locked the Royal car and jumped aboard.

Smiling happily, the Queen Mother leaves the Comet, with Princess Margaret and the Marchioness of Salisbury. In the background may be recognized Maj. F. B. Halford, Mr. W. E. Nixon and G/C. John Cunningham. Shortly afterwards, the Queen Mother despatched a most cheerful message to No. 600 (City of London) Squadron, of which she is Honorary Air Commodore; it is recorded on page 672.

The two de Havilland pilots had another member of the enterprise, Mr. E. Brackston Brown, as flight engineer; the remainder of the crew were B.O.A.C. personnel: R.Off. Robert Chandler, Steward E. Charlwood and Stewardesses Joan Nourse (a relative of the Test cricketer) and Audrey Cartmell.

G-ALYR has not yet entered scheduled service, but has made a number of proving flights, to Johannesburg and elsewhere.

The flight provided fulfilment of a wish, long expressed by Her Majesty, to gain first-hand knowledge of the aircraft which has done so much to enhance Britain's prestige in the air.

REARSBY WEEK-END

IN few flying competitions anywhere in the world can the private owner or club pilot be subjected to so searching a test of his capabilities as in the annual Auster-Ragosine Homing Cup Contest organized by the Auster Flying Club; that, at any rate, was the general consensus of opinion among the competitors at this year's event, flown last Sunday, May 25th, from Rearsby.

Not that this function is not also greatly enjoyed, as the list of over 35 entrants (easily exceeding the number taking part in any of the four previous contests) bears witness. Open to any Auster owner, the competition demands rapid and accurate navigation, as well as a fair standard of airmanship and map-reading; competitors are handicapped according to their logged flying-hours.

Last Sunday, in hot, clear weather, the participants found themselves faced with an unusually tricky series of tasks. They had to find their way round a quadrilateral course, with a different set average speed for each leg. But this was only the basis of the task: in addition, they had to fill in a questionnaire, giving the answers to such posers as: Count the bridges over the Melton-Nottingham railway between the stations marked with a ring [on your map]; mark on the map the spot shown in photograph 1 [a set of aerial pictures was provided] and see if the Kegworth windmill is (*a*) complete, (*b*) only a stump or (*c*) not there at all; mark on the map in the ringed area the spots shown in photographs 2, 3 and 4; after passing Shepshed, fly at full throttle at a constant height of 1,500ft for 3 min and record your maximum steady speed and engine revs.; fill in the ground symbols you see displayed inside the triangles at the turning-points.

The winner turned out to be G. A. Farley, flying the Autocar, G-AJYY, in which he came third in the Goodyear Race the previous week-end. He lost only 18½ points and was presented with the Auster-Ragosine Trophy and a replica, in addition to £10. The navigator—his nephew, Mr. Cowan—received £5.

Second prize—a silver tankard presented by Dunlops, and £5—went to A. K. Baker (of the Auster Flying Club, and in Autocrat G-AIBY) who was third in this event last year. On Sunday he lost 24 points; in addition to the tankard and the £5, he was also presented with the Cirrus Trophy and replica, having made the best showing in an aircraft powered by a Cirrus engine. His passenger Mrs. Pollard, was awarded £2.

A very close third (24½ points) was J. D. H. Radford, in Autocrat G-AIBH, from the Leicester Aero Club. Fourth place went to W. R. Earl (Taylorcraft Plus D, G-AHGZ) who lost 26½ points; he also won the Novice's Prize. T. Howard, flying T. Hayhow's Aiglet G-AMIH, was fifth with 27 points and Willy Baur, from Zurich, in a Swiss-registered Auster Autocrat HB-EOT, was sixth with 29 points. A prize for the best time-keeping, a Smith's aircraft clock, was awarded to R. J. White (Autocar, G-AIBX).

On the previous evening, over 100 people had attended the usual dinner-dance organized by the Auster Flying Club. The speeches at such an occasion do not lend themselves to cold reporting in the third person, but it should go on record that Tom Hayhow (in replying to the toast of "The Guests and Pilots") paid a warm tribute to the initiative of the Ragosine Oil Company in offering the trophy and cash prizes, and also in encouraging private pilots in other ways.

AIRCRAFT GOLFERS AS HOSTS

THE Aircraft Golfing Society—not to be confused with the Aero Golfing Society—held its eighth annual dinner in London last Friday, May 23rd. The secretary of State for Air, Lord De L'Isle and Dudley, V.C., replied to the toast of "The Guests"; Sir Miles Thomas related how he had lunched that day with the Queen Mother at 40,000ft; and a special welcome was accorded Maj-Gen. Griswold, the new Commander of the U.S. 3rd Air Force and Maj-Gen. McConnell, Commanding General of the 7th U.S. Air Division.

R.Ae.S. FELLOWS ELECTED

THE Royal Aeronautical Society announces that the following have been elected as Fellows: F. S. Burt, Assistant Director of Aeronautics and Engineering Research, Admiralty; A. V. Cleaver, special projects engineer, de Havilland Aircraft Co., Ltd.; L. G. Fairhurst, chief engineer, Rotol, Ltd.; R. H. T. Harper, chief stressman, de Havilland Aircraft Co., Ltd.; W. F. Hilton, chief aerodynamicist, Sir W. G. Armstrong Whitworth Aircraft, Ltd.; R. C. Morgan, chief project and development engineer, British European Airways Corporation; H. C. Smith, chief stressman, Vickers-Armstrongs, Ltd., Supermarine Works; and R. H. Weir, Director of Industrial Gas Turbines, M. o. S.

HERE AND THERE

H.P. Post for M.P.

A. CDRE. A. V. HARVEY, M.P., has been appointed deputy chairman of Handley Page, Ltd.

Another Triangle

THE Republic Aviation Corporation is reported to be working on yet another development of the original straight-winged Thunderjet. Designated XF-103, the new variant is stated to have a delta wing.

Smoky Trails in Essex

WETHERSFIELD near Braintree, is now the home of 75 F-84G Thunderjets of the U.S.A.F. 20th Fighter-Bomber wing; they arrived last week after flying from Hampton, Virginia. This unit forms the defensive part of the 49th Air Division, U.S. 3rd A.F., whose commander, Col. J. D. Stevenson, is setting up his headquarters at Sculthorpe, Norfolk. The offensive side is the 47th Bomber wing, equipped with 45 B-45C Tornadoes, to arrive very shortly.

Tea on the Lawn

AS in past years a "peaceful" atmosphere, with the accent on private flying, will be the keynote of the Royal Aeronautical Society's Garden Party, to be held at White Waltham, on June 15th. There will, nevertheless, be some "border-line" contributions, including trainers from this country and abroad. One feature will be a gliding display, some of the pilots in which will be leaving shortly afterwards to compete in the International Contest in Spain. Admission to the Garden Party is strictly confined to R.Ae.S. members and their guests.

EXPRESSIVE: Visiting the Bristol works last week, Lord Douglas of Kirtleside, B.E.A.'s chairman, listens intently to Mr. Raoul Hafner designer of the Type 173 twin-engined helicopter.

MILITARY TARGET: Showing little sign of pulling out of his dive, in spite of the tall tree nearly in his path, a U.S.A.F. F-80 pilot in Korea releases a napalm tank towards enemy vehicles parked in a factory yard.

At Whitsun

TWO air displays are scheduled for Whit-Monday. At Yeadon, near Leeds, in aid of the Soldiers', Sailors' and Airmen's Families Association, the programme will include, in addition to R.A.F. and Naval Aviation items, a demonstration by a Yugoslavian stunt team, one member of which (to the delight no doubt, of the 100,000 crowd expected) will hang by his teeth from the undercarriage of an old Soviet PO-2 trainer. Yeadon's show begins at 2 p.m. (gates open, 10 a.m.) and admission is 2s 6d (children 1s 6d, cars 5s). The Birmingham event, organized by the Midland Aero Club at Elmdon, promises to be more in the nature of an orthodox club display; it will include an inter-club "bombing" competition. It starts at 2 p.m., and admission is 1s (children 6d), or 5s (children 2s 6d) to the special enclosure.

Historic Bale-out

AN Australian pilot who has just logged his millionth mile of airline flying is Joe Herman, who, while in the R.A.A.F., had one of the most extraordinary escapes of the war. When his bomber was destroyed over Germany at night he fell several thousand feet with a faulty parachute (some records say no parachute at all); then he contacted something, and held on hard—it was "Irish" Vivash, another member of his crew, floating earthward. The pair landed safely, to be taken prisoners.

Scottish Potential

THE factory of Blackburn (Dumbarton), Ltd., where 4,000 workers were employed on Sunderland production during the war, has had nine-tenths of its capacity switched from "pre-fab" to aircraft production: the first components—Vampire wings—began to leave the factory early this month. Though present sub-contract orders are sufficient to keep the plant going for three years, it is hoped ultimately to make capacity available for the building of Blackburn and General Aircraft Freighters. As elsewhere, the biggest problem is that of manpower—toolmakers especially. Some 1,250 are already engaged, and it is hoped to find another 1,750 in two years.

High Hook-up

AMERICA'S National Broadcasting Company is planning a London-America television relay of the Coronation, using micro-wave links between ten aircraft spaced out over the Atlantic.

Collector's Piece

ONE of the rarest air-mail stamps in existence, a 60-cent Newfoundland black on a cover carried in the Marquis de Pinedo's Savoia flying-boat on its Italy-America-Italy flight in 1927, has been sold in London for £850.

Torch-bearer

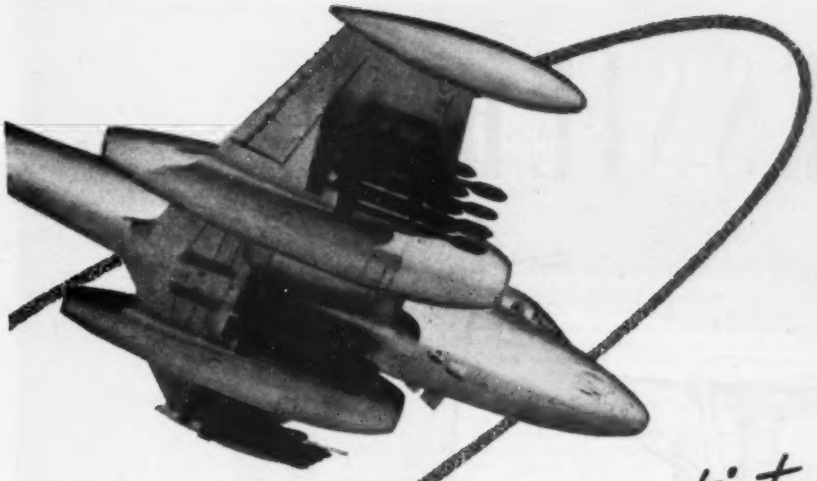
S.A.S.—Scandinavian Airlines System—has been entrusted with the transport of the Olympic Torch from Athens to Aalborg, whence relays of runners will carry it to Helsinki, where the Olympic Games begin on July 19th. No fire hazard will arise, for before the DC-6 takes off from Athens the flame will be transferred to a Davy lamp.

Australian Aluminium and Oil

A FIRST shipload of men, building materials and machinery left Darwin, Australia, at the end of April, for an unnamed island off the coast of the Northern Territory, where substantial deposits of aluminium ore are to be examined. Australian oil is also in the news: Mr. F. J. Watson, from the London firm of Seismograph Services, Ltd., is leader of a party who are soon to survey for oil in the Exmouth Gulf area of Western Australia.

Truth is Stranger . . .

LAST week, events following the P.A.A. Stratocruiser crash in the Brazilian jungle (on April 29th) assumed a character rivalling the plot of a Graham Greene novel. All 50 occupants of the aircraft—which was said to have valuable diamonds on board—had lost their lives in the accident. Members of an official search-party organized by the American and Brazilian authorities, and equipped with a U.S.A.F. helicopter, went to the scene. A few days later their leaders were made captive by an unofficial search-party of 30 armed men who had parachuted in before them. Some were released, but



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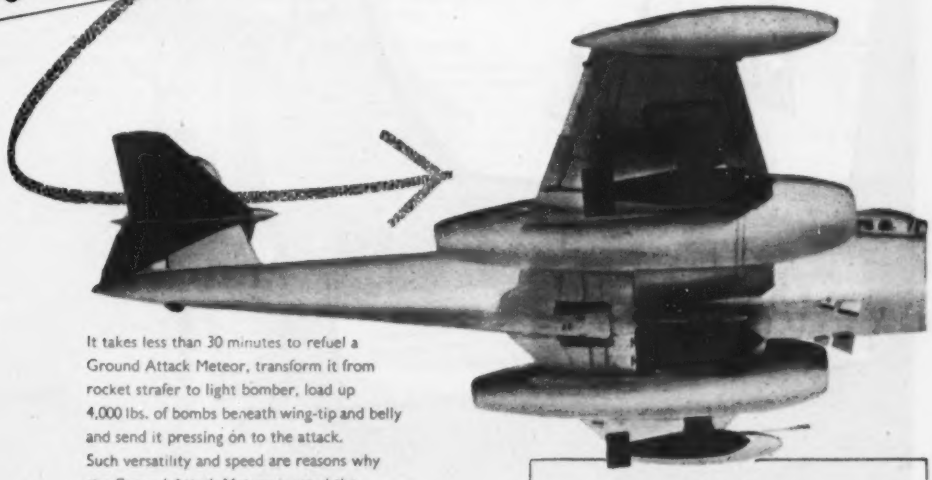


It takes less than 30 minutes to refuel a Ground Attack Meteor, transform it from rocket strafer to light bomber, load up 4,000 lbs. of bombs beneath wing-tip and belly and send it pressing on to the attack. Such versatility and speed are reasons why the Ground Attack Meteor is rated the world's most effective ground support aircraft.

CONGRATULATIONS TO DOWTY 1931 1952

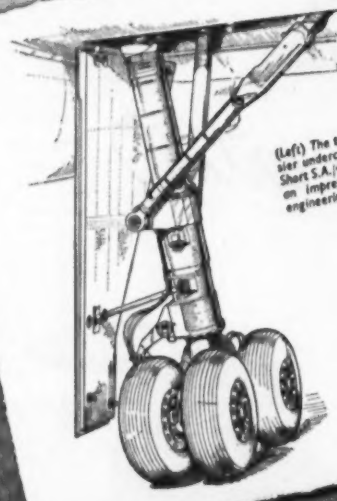
Gloster
GROUND ATTACK
Meteor

GLOSTER AIRCRAFT CO. LTD.
Hucclecote, Gloucestershire

MEMBER OF THE HAWKER SIDDELEY GROUP / PIONEER...AND WORLD LEADER IN AVIATION

MESSIER *Landing Gear*

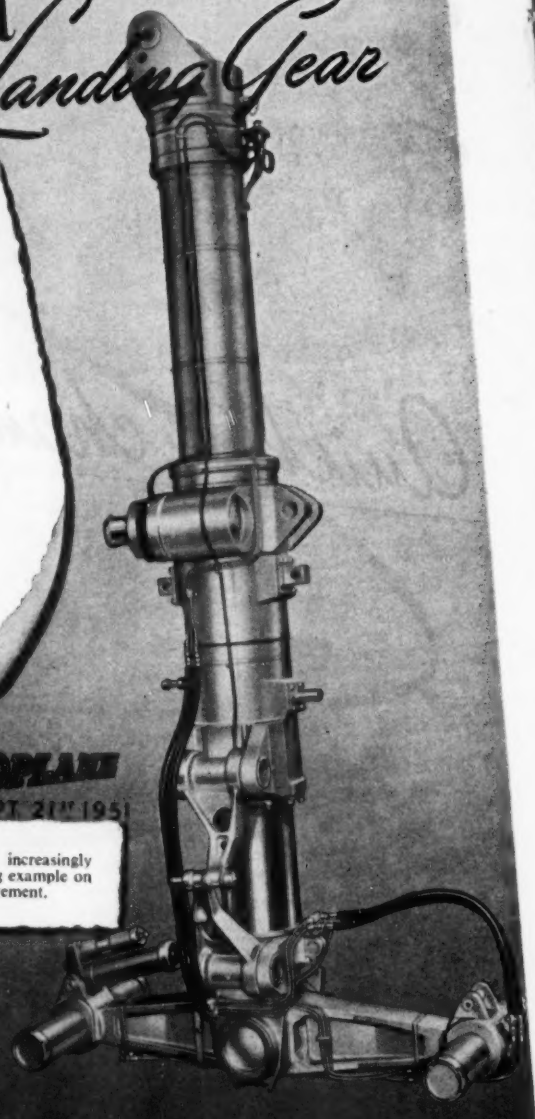
FROM FLIGHT SEPT. 21ST 1951



(Left) The towering Messier undercarriage of the Short S.A./4 jet bomber—an impressive piece of engineering.

FROM AEROPLANE SEPT. 21ST 1951

Bogie-wheel undercarriages are becoming increasingly common at Farnborough, and the inward-retracting example on the Short SA.4 is a magnificent engineering achievement.



Twenty-three years experience in the design of hydraulic landing gear for aircraft is incorporated in every Messier undercarriage design.

BRITISH MESSIER LTD · GLOUCESTER

HERE AND THERE . . .

until May 20th one U.S. civil aviation official and the helicopter pilot were held as hostages, the latter being forced to ferry supplies to the parachutists. Release followed an ultimatum from a force of Brazilian Army paratroops. The oddest aspect of the story is that the unofficial party was said to be sponsored by "Adhemar de Barros, head of Aerovias Brasil (Brazilian Airlines), and former Governor of Sao Paulo."

S.A.E. Award

FOR his paper on *The Use of Titanium*, Mr. O. A. Wheelon, production-design engineer of the Douglas Aircraft Company, has been awarded the Wright Brothers Medal by the Society of Automobile Engineers.

"Commander, you might tell Gibson it's unnecessary to salute the quarter-deck each time he passes."

Sound Advice

THE "commercial intelligence" value of the trade and technical Press was emphasized by Mr. D. J. Liston, M.B.E., of the Metal Box Co., Ltd., in a recent address to members of the Incorporated Sales Managers' Association. He suggested that systematic reading and analysis of journals might be carried out by a member of a firm's staff trained for the purpose.

SOVIET SIDELINE: In the "World's Airlines" directory in "Flight" of May 16th the equipment of Russia's Aeroflot was quoted as consisting of Il 12s, Li 2s (Soviet DC-3s) and smaller types. This artist's impression shows, according to information believed to be reliable, one of those smaller types—a biplane of unknown designation used on the Aeroflot routes over the Pamir Mountains of Central Asia. A crew of two is carried; passenger capacity is unknown.

Missile Licence Offered

AMONG proposals from U.S. firms to issue licence agreements, advertised by the Mutual Security Agency Mission to the U.K., is one from George Wise, of Washington, D.C., who seeks European firms to produce his "multiple-type guided missile."

Aero Golfing Society

THE first summer meeting of the Aero Golfing Society, held at Ashridge on May 6th, resulted in the Jubilee Challenge Cup being won by K. D. Morgan, with 73 points. In the afternoon competition, first prize was won by J. C. Macpherson and Lt-Col. L. H. N. Bickmore, with 39 points (Stableford scoring).

To Promote Research

SIX months ago the English Electric Co., Ltd., established a research fellowship at the University of Glasgow, and now comes the announcement that it has arranged for a similar fellowship, valued at £500 a year, to be made tenable at the College of Aeronautics, Cranfield. The purpose is to promote the study of problems in advanced aeronautical engineering, and holders of the fellowship will be mainly concerned with research into such subjects as vibration, stability and control, all of which are of particular importance at the high speeds of flight now being attained.

IN BRIEF

AT a recent board meeting of the R.F.D. Co., Ltd., W/C. N. J. Hulbert, M.P., was appointed chairman and Sir Norman Nixon a director.

* * *

The Plessey Co., Ltd., state that Mr. E. H. Ouston, B.Com., A.C.A., has been appointed an executive director, and joint secretary to act with Mr. H. L. Jarvis, the present secretary.

* * *

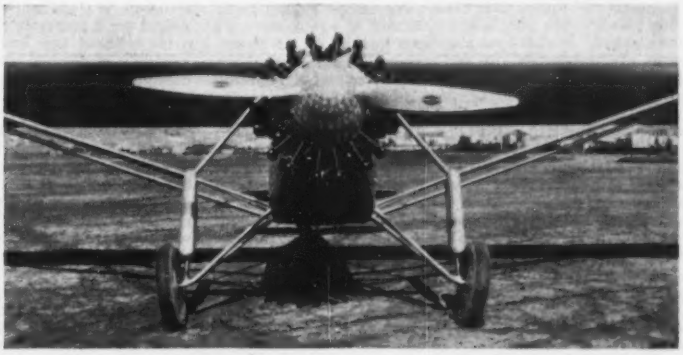
A very fully illustrated brochure from Bakelite, Ltd., 18, Grosvenor Gardens, London, S.W.1, illustrates some of the many uses of their Bakelite, Warerite and Vybak plastics.

* * *

CS Aircraft Spares and Components announce that the title of the business has now been registered and approved as Components and Spares (Aircraft), Ltd., and that it will accordingly be known as "C and S Aircraft." Offices are at 446, Strand, London, W.C.2 (Temple Bar 9840 and 9864).

* * *

Mr. A. H. A. Bastable, of the aircraft division of the Hymatic Engineering Co., Ltd., has just completed a ten-day tour of Europe, during which he visited customers for the firm's airborne compressed-air equipment, including Fiat of Turin and most of the other major Italian constructors.



ATLANTIC PROGRESS: Last week saw the twenty-fifth anniversary of Charles Lindbergh's memorable Atlantic flight, from New York to Paris, nonstop, in 33½ hours for the 3,600 miles. This head-on view of his Ryan monoplane 220 h.p. Wright Whirlwind engine shows that clean aerodynamic design was a contributory factor, though ring cowlings had not yet come into their own. It has been calculated that some 1,500,000 fare-paying airline passengers have crossed the Atlantic since that epic flight, and that, during a comparable 33½-hour period last week, 1,800 men, women and children were making the journey in the luxury and comfort provided by modern scheduled air services.

PROPHECY AND ACHIEVEMENT

—in Aeronautics: Fortieth Wilbur Wright Memorial Lecture, by the Chief Scientist of the Ministry of Supply

THIS year's Wilbur Wright Memorial Lecture—the fortieth of the series—was delivered before the Royal Aeronautical Society last evening, May 29th. The paper was a notable one, by Sir Harry M. Garner, K.B.E., C.B., M.A., F.R.Ae.S., Chief Scientist, Ministry of Supply—a post to which he was appointed in 1949. Sir Harry's aeronautical experience is of long standing, for he was at the R.A.E. in 1917, and was appointed Chief Technical Officer at the M.A.E.E., Felixstowe, in 1929. He was Deputy Director of Scientific Research at the Ministry of Aircraft Production from 1942 to 1945, and then Principal Director of Scientific Research (Air), Ministry of Supply, until 1949.

A digest of the lecture follows.

Thinking of the great achievement that this Wilbur Wright Memorial Lecture celebrated (said the lecturer in introducing the paper) it was not surprising that many previous lecturers had taken the opportunity of surveying the progress made since 1903. Although some had looked into the future and predicted good progress, none had foretold the rapid progress that had actually taken place. But forecasts were necessarily made on the basis of existing knowledge and could take no account of entirely new ideas which might lead to great advances in aircraft design. There had been a number of occasions in the history of aeronautics when it seemed that progress was coming to a standstill. Men of outstanding ability had come forward suggesting that the end of development in one direction or another was being reached. Their fears had always proved unfounded.

The lecturer then considered the increase in speed of aircraft during the past 40 years. The progress made had resulted, firstly, from a gradual improvement in knowledge of materials, structures, aerodynamics and engine design and, secondly, from inventions which had made radical alterations to aircraft design. Thus progress in aeronautics might be thought of as consisting of gradual improvements broken at intervals by distinct discontinuities.

One of the earliest problems facing aircraft designers was the so-called "square-cube" law. The earliest aircraft could only just lift their own weight with that of a pilot and very little petrol. At that time numerous theories on the limitations of the possible size and weight of aircraft were put forward; in 1912 A. R. Low had suggested that the limiting all-up weight of an aeroplane would be a little over 2,000 lb.

Anyone asked to give a limiting weight today might say that under present conditions the limit would be about 1,000,000 lb. The lecturer gave several reasons for this increase, among which was a reduction in structural weight mainly caused by better weight distribution, improvements in materials and increases in wing-loading. The strength of aluminium alloys had increased from a maximum stress of 5 tons/sq in in 1900 to a possible 40 tons/sq in today, while wing-loadings had risen from the 1½ lb/sq ft of the Wright Brothers' 1903 aeroplane to about 100 lb/sq ft for bomber and transport aircraft today.

Thus the difficulties of the square-cube law had been evaded, rather than overcome, by not adhering to geometric similarity.

The increase in wing-loadings combined with the improvement of materials had finally decided the vexed question of monoplane *v.* biplane; although the biplane was being extolled as late as 1929, the monoplane, with stressed-skin construction and high wing-loading, had become supreme ten years later.

The achievement of high speed was one quality in which the aeroplane was ahead of all other forms of transport. At all stages, said the lecturer, the achievements in speed had outstripped the prophecies of the experts. Lanchester, in 1914, had said: "A maximum flight speed . . . of about 120 m.p.h. is one for which it is already possible to design, though it is likely that some years will elapse before speeds materially in excess of this will be reached." Ten years later this speed had been more than doubled. Glauert and McKinnon, in 1923, concluded that "the highest speed attainable with the present type of engine is a little over 300 m.p.h. when the stalling speed does not exceed 75 m.p.h."

The qualification of the stalling speed was important; while designers would have been satisfied with a speed range ratio of 4 to 1 for some years after the 1923 report, the use of better wing sections, high-lift devices, and engines of increased power now permitted ratios of better than 5 to 1.

The lecturer then turned his attention to the question of speed records which, in the past, had always been made near the ground. One reason for this was the spectacular value of such flights, but perhaps more important was the difficulty of recording speeds accurately at height, as well as of making sure that the record run was flown sensibly level. The stage had now been reached at which speed records near the ground had little significance. They would not have persisted so long were it not that higher speeds could be obtained near the ground before compressibility effects became marked. Major discontinuities in the development of aircraft performance had resulted from the introduction of the cantilever monoplane (about 1935), and also from the invention of the gas turbine, and particularly of the turbojet.

No one was likely today to underestimate the effect of improvements in engine design on aeronautical progress. Although other factors than weight were important today, a low weight-to-power ratio was still very important. The prospects did not seem very hopeful to Lanchester in 1914, who said "it is difficult to believe that any great reduction of weight per h.p. can be effected on the best figures available today without any sacrifice of reliability." The present reliability of engines was of a much higher order than that thought sufficient in 1914, and the weights per h.p. of the largest engines were about one-third of the values Lanchester had in mind. The specific consumption of piston engines had been improved in a less spectacular fashion, present-day figures being some 20 per cent better than those for the early engines. It had, however, to be borne in mind that low consumption conflicted with low weight-to-power ratio, and the modern engine had to provide many ancillary services not required of earlier engines.

The lecturer then examined particular aspects of engine design, including the development of both superchargers and turbo-blowers. A particularly difficult problem, shared by engine and airframe designers, was the provision of adequate engine cooling. An ingenious solution was the rotary engine; other early air-cooled engines were in continuous trouble due to the low aircraft forward speed. Pye, in his *Internal Combustion Engines*, in 1934, said "on the fastest aeroplanes the necessary dissipation of the waste heat from the power-plant is within sight of placing a limit upon the maximum speed attainable." The limit had not, in fact, been reached, although it had always seemed to be in sight.

A new factor affecting the speed of aircraft—the compressibility of the air—had begun to make itself felt in the years before the second world war. Previously, only the airscrew blade tips had been affected by this factor. The first indication of serious trouble had come from high-speed dives during fighter combats, when shock-waves and flow breakdown had occurred due to very high local air velocities. Scientists had thought that not only would supersonic flight be difficult, but that flight in the region near the speed of sound would be highly unstable and dangerous. It was now known that the difficulties were less serious than had been feared. In particular, the use of swept-back wings had facilitated high-speed flight by delaying the onset of shock-stalls.

The state of knowledge—or ignorance—when serious attention first began to be focused on transonic and supersonic flight was shown by Fig. 1. Drag coefficients up to about M 0.9 were known fairly accurately from tunnel and flight measurements, while supersonic theory, supported by tunnel test-results, enabled fair calculations to be made for that part of the curve above M 1.2. Between these limits, tunnels had not been controllable to give steady conditions. At best, it had appeared that the drag coefficient near the speed of sound would be at least six times that obtained at low speeds.

The present picture was given in Fig. 2. It was seen that the peak drag for a straight-winged aircraft was not so high as had been feared. In practice, it had been found that, while transonic flight caused considerable changes in the flow pattern round an aircraft, no impossible conditions were met either in drag or control. The experimental straight-winged Bell XS-1 had made a number of flights in the transonic region without difficulty.

The components making up the profile drag were shown in Fig. 3 and Fig. 4 for straight- and swept-winged aircraft respectively. The greatest improvements appeared likely to be reductions in the wing wave-drag; this function was proportional to the square of the wing thickness, and an intensive effort could be expected to reduce thickness, even at the expense of weight. The transonic advantage of the swept wing, so clearly shown in Fig. 4, was offset by its higher stalling speed and bad structural shape. Thus, for fair comparison, the area and thickness of a swept wing should be greater than for a straight wing.

The next illustration provided by Sir Harry Garner was Fig. 5, giving forecast drag coefficients for possible future aircraft with variously swept thin wings of such areas as to give the same landing speed to each aircraft. The vertical drag scale of this set of curves was double that of Figs. 1-4. The thickness of the straight wing was half that of the straight wing of Fig. 4, resulting in one-quarter of the wing wave drag. Beyond about M 1.3 the swept wing showed to considerable advantage.

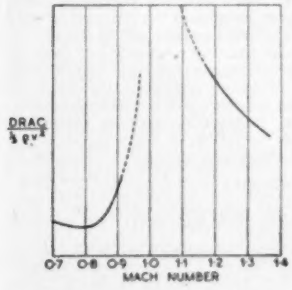
Using the smaller engine (thrust curve A) the advantage of sweepback was apparent; if thrust B were available the straight wing had an overwhelming advantage. In fact, the thrust curve was almost parallel to the drag curve and it appeared that, once the peak drag had been overcome, small thrust increases would produce large increases in speed.

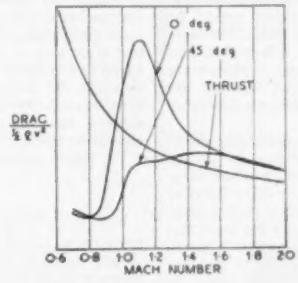
Before very long, said the lecturer, it would be possible to design aircraft in which the engine thrust was greater than the all-up weight. This opened up the possibility of taking-off and landing vertically; the method of operation of such aircraft might well be revolutionary.

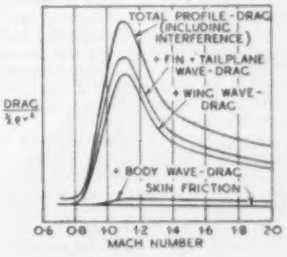
Until a few years ago the basic designs of military and civil aircraft were similar. The qualities demanded from long-range bombers and military transports were also requirements of civil aircraft. The lecturer cited the inter-war series of Short flying-boats as a good example of this. Now, however, the parting of the ways had been reached. The speeds of almost all types of military aircraft were so high that the main problems were ones of compressibility; military attention was no longer directed towards reducing drag at subsonic speeds. As a result those responsible for the development of civil aircraft would no longer be able to rely, as they had done in the past, on picking up the crumbs which fell from the rich military man's table. If civil aircraft were to improve, research and development adequate for their needs had to be put in hand.

The main problem facing the designer of civil aircraft was that of improving economy at subsonic speeds. It appeared that the major contribution to this end would have to come from aerodynamic improvements. There was still much that could be learnt, particularly about laminar flow over swept-back wings. It also appeared that very great improvements could be obtained by the use of boundary-layer control. Although this implied many difficult structural and mechanical problems, the profile drag could, theoretically, be reduced by such a means to about one-tenth of that of contemporary aircraft.

In order to achieve economical flight the induced drag would also have to be reduced. In the past a steady reduction







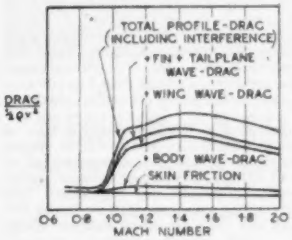


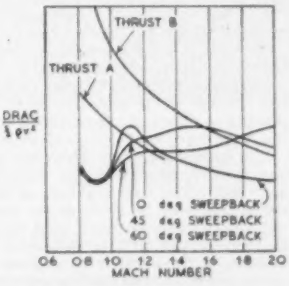
Fig. 1 (top left). Immediately post-1945 state of knowledge of the drag coefficient of an unswept wing, with theoretical transonic values dotted.

Fig. 2 (above). Total drag and thrust at 40,000ft of present-day aircraft with straight and swept wings of equal areas.

Fig. 3 (top right). Components of profile drag for straight-wing aircraft.

Fig. 4 (left). Components of profile drag for swept-wing aircraft.

Fig. 5 (right). Total drag and thrust at 40,000ft of possible future aircraft with equal landing speeds.



PROPHECY AND ACHIEVEMENT . . .

in profile drag had been accompanied by a reduction in induced drag in spite of increases in wing loading, due to the effect of steady increases in cruising speed. In order to avoid compressibility troubles it seemed likely that civil aircraft cruising speeds would settle down at about M 0.7 or M 0.8. Assuming that the long-range civil aircraft would cruise at a speed equal to, or slightly above, that for minimum drag, it was found that a reduction in induced drag required for the laminar-flow aircraft could only be obtained by increasing the wing area.

The effect of altering the aspect ratio was shown in Fig. 6, in which figures had been plotted for two aircraft, a present and a future airliner, the later aircraft having one-fifth of the profile drag of the former. The actual aspect ratio and wing-loading to be used would depend on several factors other than aerodynamic ones, such as the increase in structure weight with aspect ratio, and the deterioration in take-off with the reduced engine power required for the laminar-flow aircraft.

As Fig. 6 was based on aerodynamic functions only it could take no account of such factors; this had resulted in a higher set of wing-loadings for the present-day airliner than was generally the best for all-round performance.

The reduction in optimum wing-loading resulting from reduction in profile drag was remarkable. It indicated a trend of design which in some way would make the designer's path easier and would enable the passenger of the future to be provided with more roomy accommodation than could be made available today. Estimates, based on the present scanty knowledge of the best constructional and mechanical methods of achieving laminar flow, showed that, when full allowance had been made for the increased structure weight, ranges of the order of 12,000 miles should be achieved.

Griffith had attacked the problem of efficient transport by seeking to determine the optimum aeroplane for a range suitable for a transatlantic service. He found that with a thick-winged aircraft provided with suction the cost per passenger could be reduced to about half that obtainable for conventional aircraft. An interesting point was that the wing loading for his aircraft was about 36 lb/sq ft, a much lower value than that of conventional modern aircraft.

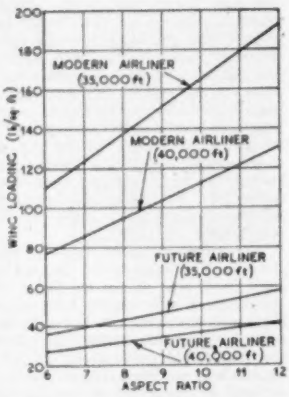
No one had been rash enough in 1929 to prophesy that the streamlined aeroplane would be achieved in 20 years, and the lecturer was not going to say that the laminar aeroplane, which offered such brilliant possibilities today, would be achieved in another twenty. But he felt sure that if the same expenditure of scientific and engineering effort that had been devoted to streamlining during the past 20 years were applied to what he might call "laminarizing" during the next twenty, great progress would be made towards achieving the ideal aircraft.

The lecturer said that he ought not to leave the problem of the long-range aircraft without some reference to the possibilities of nuclear propulsion. The design of an aeroplane with a nuclear power-plant was said to be in hand in the United States. But at present the weight of such a plant with the shielding devices necessary to protect the crew and passengers was so high that the weight of the aircraft would need to be something like 500,000 lb. Sir Harry did not think that a successful aeroplane of this kind could be achieved within the next 15 years.

As far as the achievement of long range was concerned, further reductions in drag would not be important. But any reduction in drag would result in a power plant of longer life and the aim of the scientists ought to be to do everything possible to reduce the squandering of the sources of energy that were being used up so rapidly by modern man.

The flying-boat, in the lecturer's view, would play a great part in civil aviation in the future. The construction of large and costly land aerodromes using valuable land that would otherwise be available for agriculture and industrial use, would surely be found to be too great a price to pay for the convenience of civil aviation. There was a possible solution to the problem in military aircraft by the use of excess power, but this solution was not likely to be practicable

Fig. 6. Airliner wing loading plotted against aspect ratio for flight at the minimum drag condition at M 0.76.



or acceptable for civil aircraft for a long time to come. Flying-boats, using water aerodromes of less cost than land aerodromes, and interfering with other amenities far less, would surely provide the ultimate solution.

A few years ago the efficiency of the flying-boat as a flying machine was only equal to that of a large landplane at very large sizes—at weights of about 300,000 lb or greater. Recent developments, firstly in the design of hulls with a much smaller beam in relation to their length, and secondly, in the use of turbojets, had put the flying-boat in a more favourable position. Today a flying-boat could be designed, at a weight of about 100,000 lb, as efficient as a landplane of the same weight. Sir Harry saw the flying-boat as a formidable competitor to the landplane as the long-range transport of the future. It might be that the lightly loaded flying-wing seaplane put forward by Roxbee Cox and Coombes as long ago as 1935 would provide one of the solutions to long-range transport.

In conclusion, the lecturer said a few words about helicopters. The development of helicopters, even in the United States—where a large effort had been devoted to them—had been disappointingly slow. The ultimate solution to the helicopter problem might be one of the various forms of jet propulsion, although there remained many problems to be solved in this field.

The study of the prophecies and achievements of the past necessary for the preparation of the lecture had been a fascinating one. If any lesson could be drawn from it, it was surely that one should not be so rash as to assume the mantle of prophet and predict solutions to aeronautical problems on inadequate data. But Sir Harry had been tempted to disregard the experience of the past and to make some prophecies, or at any rate surmises, on the future. He had done this in the belief that the predictions of the past, based in the main on sober theory and sound scientific data, although far surpassed by future achievements, had at the time stimulated intense thought and a determination to achieve the impossible. Perhaps the guiding philosophy should be that of Clough :

"If hopes were dupes, fears may be liars."

ADASTRAL PRODUCTION

THE Adastral Players, whose members are recruited from the Air Ministry and Ministry of Civil Aviation, are always adventurous in their choice of plays, and they recently presented their sixth main production since the last war, Patricia Morrow producing the company in Philip King's *On Monday Next*, at the Fortune Theatre in London.

The action of this three-act comedy takes place on the stage of a small-town repertory theatre, during the course of the first rehearsal of a new—and extremely bad—play. The entertainment hinges on the trials of the producer, a young man himself constantly posing and acting, and thereby giving his cast as exhausting a day as he has himself.

In this long and difficult part Roy Widdup made the most of the considerable opportunities offered him, and two other players whose performances stood out from the general competence of the cast were Pamela Bickell and Geoffrey Briggs, the latter giving the impression that he had considerable stage experience. The secret of this entertaining evening must, we feel, lie in the fact that the whole production had what so many amateur efforts lack—pace and punch.

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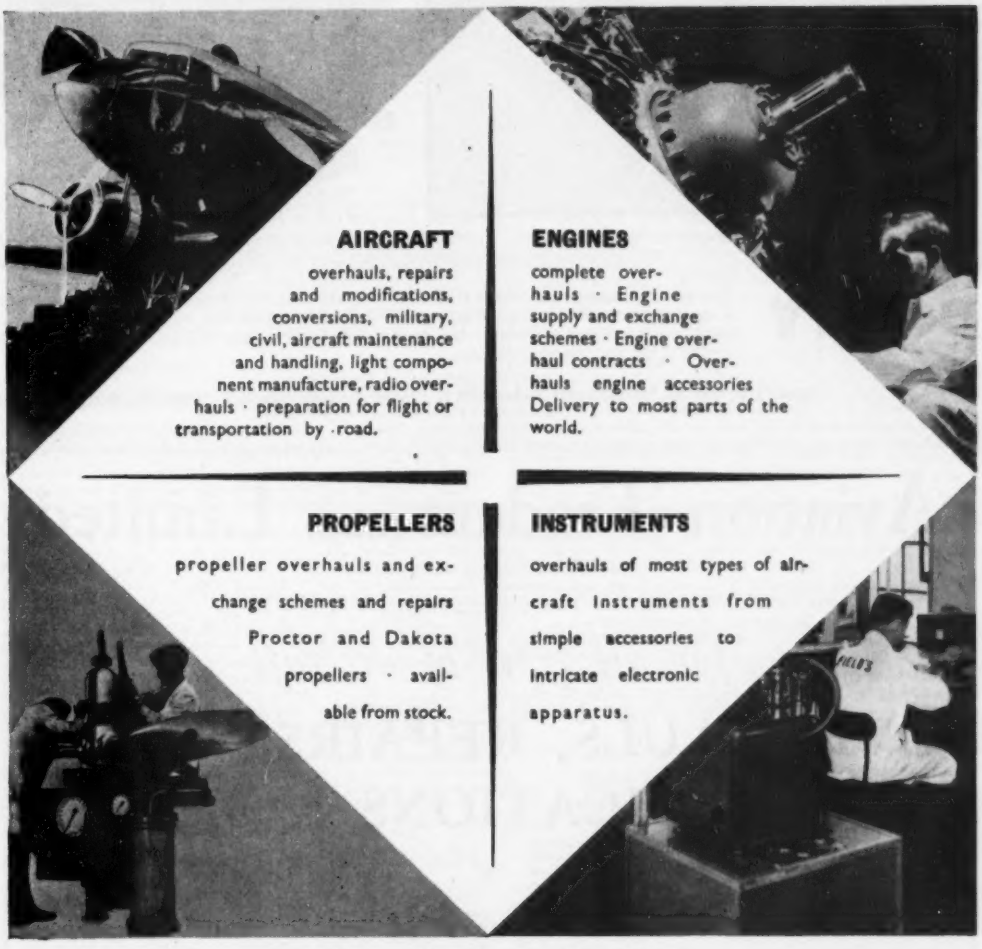

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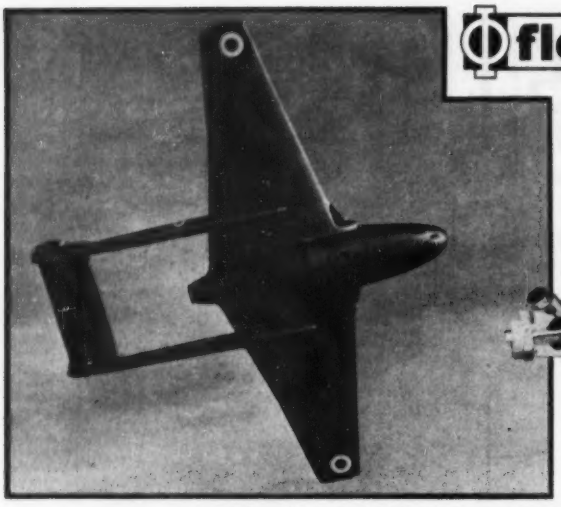

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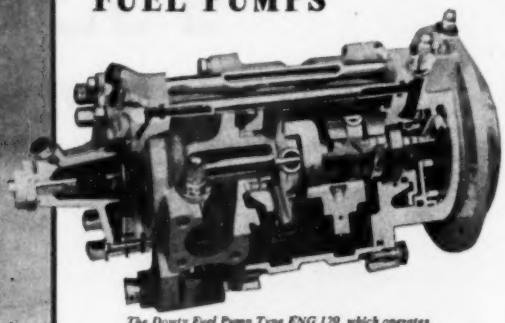

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THE AERONAUTICAL BOOKSHELF

Understated

"Tedder," by Roderic Owen. Collins, St. James's Place, London, S.W.1. Price 18s.

IN one of the appendices to this book, Roderick Owen explains how he inserted an advertisement in *The Times* which read: "Lord Tedder.—Writer of biography wishes contact anyone with interesting story to tell, particularly childhood and early career." Various people replied in the fond belief that Lord Tedder was breaking into authorship and wanted to grapple with *their* biographies; one very old lady wrote that "the earliest recorded event was my being carried by my devoted nurse to enjoy a public hanging."

Whereas few readers and still fewer publishers would be interested in the story of elderly Miss X, one of the penalties of greatness is that somebody will inevitably come along one day with the object of publicizing in a biography all the more spectacular and, therefore, less typical aspects of one's life. It is to Lord Tedder's credit that, in his case, the result contains little hero-worship, no details of precocious childhood or axe-grinding manhood, and nothing that would bring a blush to the cheek of the most prim maiden aunt. Indeed, he is so modest and unassuming that Roderic Owen was given little first-hand material on which to base his book—a fact that becomes all too obvious to the reader.

There *had* to be a book on Lord Tedder, who, as Deputy Supreme Allied Commander in 1944-45, was second only to General Eisenhower in responsibility for the successful outcome of the war in Europe. Roderic Owen has done his best by filling in the story with examples of Tedder's achievements in organization and strategy, and the work of his air forces. But he gives only tantalizing glimpses of Tedder the family man; of the man who could overcome easily differences of opinion with American and even Russian officers; and of the commander whose character and deeds earned only praise from his contemporaries.

Sinister Wonderland

"The White Rabbit," by Bruce Marshall. Evans Brothers, Ltd., Montague House, Russell Square, London W.C.1. Illustrated. 16s.

The White Rabbit is the story of a very brave man, told with commendable simplicity and skill. It is no book for the squeamish, or for those who believe the rearming of Germany to be the best answer to our present military dilemma. There is little glory and honour in the sort of warfare described in its 262 pages—only extreme brutality, treachery, sordidness and human misery beyond belief.

"The White Rabbit" was one of the code-names used during the war by W/C. F. F. E. Yeo-Thomas, G.C., M.C.; and this is the story of his exploits as a British agent in France, organizing the Maquis, and of his treatment by the Gestapo and S.S. after his betrayal and capture. It takes the reader to secret armed camps run by French patriots under the noses of the German Army; to a cold, lonely field in France where the arrival of a Lysander meant the difference between life and death for three people; inside the dreaded concentration camps of Buchenwald and Gleina, where agents, airmen and civilians alike were called by radio to death in its most horrible forms.

Yet the book is not all gloom and despondency. There is humour both grim and gay in its pages, and, above all, it leaves one with a great feeling of pride and humility in belonging to a country that can still produce such men as Yeo-Thomas. Simultaneously, it pays belated tribute to the Lysanders and their pilots, whose war-time "cloak and dagger" missions have never received the recognition they so richly and hazardously earned.

Three Arms

"Norway—the Commandos—Dieppe," by Christopher Buckley. Her Majesty's Stationery Office. Illustrated. 10s. 6d.

Shortly after revising the proofs of *Norway—the Commandos—Dieppe*, Christopher Buckley was killed while reporting the war in Korea for the *Daily Telegraph*. His book helps to emphasize the extent of our loss, as it is by far the best of the semi-official "popular military histories of the Second World War" so far published.

In some respects Mr. Buckley had an easier task than authors of the earlier books. He is dealing with smaller bodies of men and so can make the narrative more personal; and the actions he describes were often more exciting than, for example, the grim, endless slogging campaign in Italy. But the real key to the success of this story is that its author has tried to view the battle-scene as a whole. His thoughts have not become bogged down in snow and mud with the infantry: he gives the air forces and navies a share in the story and is not afraid to comment alike on causes of victories and defeats. In particular, we are able to gauge the extent to which lack of effective air support contributed to our early misfortunes in 1940.

Perhaps Mr. Buckley does less than justice to the handful of gallant Gladiator pilots who fought the *Luftwaffe* at impossible odds from a frozen lake in Norway, in an attempt to give our Expeditionary Force some form of air support. But, on balance, it was a sadly inadequate force. We see later how experience in air support was slowly but surely obtained by the R.A.F. in covering such operations as the Commando raid on Vaagsö and Maaloy in December, 1941, when Hampdens laid effective smoke screens and Blenheims and Beaufighters provided fighter cover. Modern amphibious warfare, involving close co-operation by all three Services, had its beginnings in these operations. We are able to read again of the successful raid on the radar station at Bruneval—one of the few intelligent uses of paratroops in World War II—and, finally, of the tragic Dieppe raid, during which the Royal Air Force achieved air superiority and a considerable defensive victory—a happy augury for the Allied invasion of Europe which it foreshadowed.

Mighty Machine

"How the Civil Service Works," by Bosworth Monck. Phoenix House, Ltd., 38 William IV Street, London, W.C.2. Price 25s.

IT is unlikely that many taxpayers who are not themselves Civil Servants have more than a sketchy knowledge of the workings of the machinery of Government, and anyone wishing to educate himself in the subject, or who is interested to learn how his contributions towards the administration's upkeep are used, could not do better than peruse Mr. Bosworth Monck's work. To attempt a lucid explanation of the methods by which this country is run is obviously a most formidable undertaking. Mr. Monck is, we believe, a pioneer in this respect, and he is to be congratulated on having produced a concise and comprehensive review of the structure and functions of the vast administration.

Of particular interest are the chapters concerning the Ministry of Civil Aviation and the Ministry of Supply, included in the section devoted to the organization and work of individual government departments. In this part also is an enlightening chapter dealing with the defence departments, in which the administration and responsibilities of the Air Ministry are surveyed and related to the functions of the other Service ministries.

OTHER BOOKS RECEIVED

Mathematics, Queen and Servant of Science, by E. T. Bell. G. Bell and Sons, Ltd., York House, Portugal Street, London, W.C.2. Price 21s.

Helicopter Analysis, by A. A. Nikolsky. Chapman and Hall, 37, Essex Street, London, W.C.2. Price 60s.

How and Why of Aircraft and Their Engines, by J. H. Stevens and M. F. Allward. Putman and Co., Ltd., 42, Great Russell Street, London, W.C.1. Price 10s. 6d.

Adhesives for Wood, by R. A. G. Knight. Published under the authority of the Royal Aeronautical Society by Chapman and Hall, 37 Essex Street, London, W.C.2. Price 25s.

Books Recommended by "FLIGHT"

Fellowship of the Air (Jubilee Book of the Royal Aero Club). By B. J. Hurren. Price 30s. net; by post 31s 1d.

Mechanics for the Home Student. By Eric N. Simons, in association with W. D. Burnet, B.Eng., Lecturer in Mechanical Engineering at Sheffield University. Price 7s 6d net; by post, 7s 10d.

A Racing Motorist: His Adventures at the Wheel in Peace and War. By S. C. H. Davis of *The Autocar*. Price 10s 6d net; by post, 11s.

Rallies and Trials. By S. C. H. Davis of *The Autocar*. Price 15s net; by post; 15s 7d.

Roads of France—A Guide to Tourist Routes. By A. G. Douglas Clease. Price 5s net; by post, 5s 2d.

Yachting World Annual, 1951-52 (Incorporating *Yachtsman's Annual*). Price 30s net; by post, 31s 1d.

Obtainable at all booksellers or direct from the Publishing Dept., Dorset House, Stamford St., London, S.E.1.

Our American Correspondent Reports . . .

EVERY year the American Society of Automotive Engineers holds a "National Aeronautic Meeting, Aircraft Engineering Display, and Technical Air Review" in the New York area. Last year the papers read at this meeting dealt chiefly with the development and operation and requirements of the local feederline transport and were of very considerable interest. This year they covered a rather wider bracket of subjects. The "aircraft engineering display" (which held the type of exhibit one associates with the gallery of the Paris Aero Show) was situated in an ante-room off the main lecture hall, and the "technical air review" was at Idlewild International Airport. The latter event consisted of a limited number of not-very-new types of military and civil aircraft, and a small static exhibit—chiefly gas turbines—in a tent. Most of the things in the tent were either poorly mounted or poorly shown—or both. In one instance an old packing-case was used as a stand. Notable exceptions were an excellent sectioned Bristol Proteus and the General Electric products, though these, too, suffered from lack of room. Other British-designed products were a Mamba, a Sapphire and a Rotol turboprop airscrew. The Continental Motors Corporation of Michigan showed two or three French Turboméca engines. Proportionately, Europe was not too badly represented.

But to those who would like to see an aircraft display along Farnborough lines develop in the States it was a disappointing show. It left one wondering why the largest and richest aircraft industry in the world should participate so half-heartedly. That the show was quite unworthy of the industry's position or products cannot have been due to lack of ability or energy on the part of the organizing committees. If either the industry or the armed Services don't care about such displays, or don't feel that the S.A.E. is the right one to organize them, it would be better to do nothing at all. It is true that everyone concerned is up against the throttling hand of Security; but, even granted the necessity for some secrecy (a word often confused with security here), the popular magazines alone have printed enough photographs and descriptions of new equipment to make up a much better showing than that at Idlewild. Perhaps, too, the Aircraft Industries Association (which, in the end, must be the arbiter) feels that until such time as it can sponsor a display along the lines of the S.B.A.C. Farnborough Show itself, it is best to hold off.

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THE papers read during the three days of the S.A.E. meeting suffered from the old trouble of too much compression and too little discussion. There is always a tendency here to try to do too much in too short a time, and this spoils what are often first-class papers, and prevents any subsequent discussion from developing as it should. Three British papers were given, and all suffered in this way. It was said that the authors were not warned of any particular time limit until after they had accepted the invitation and begun their drafts; that a limited period for presentation was then suggested, and that eventually each lecturer's time was further cut to some thirty minutes. If true, this is naughty, as it resulted in all three of the papers (R. C. Morgan on *Introduction of New Transport Aircraft*, S. Scott-Hall on *Government Collaboration in Aircraft Development* and A. Cdre. G. J. Powell on *Operation and Economics of the Channel Air Ferry*) being given in so condensed a form that none of the authors was really able to develop his subject to the full; it was left to the audience to buy the reprints of these three excellent papers if they wished to know more.

By far the most virile part of the meeting was a morning session devoted to *Control of Aircraft Ground Noise*—a discussion which soon enveloped aircraft air noise as well. A number of speakers—some from the audience—took part, and plenty of ideas on noise suppression were put forward, but unfortunately none of them seemed to be of any immediate practical use in solving those problems which face airport operators at the moment. It was generally agreed that, at some time in the future, airport and aircraft noise could and would be brought down to acceptable proportions, but that the only complete solutions at the moment were utterly impracticable — ranging through (*a*) closing the airports altogether, (*b*) buying up all the surrounding land and (*c*) moving the sites to deserted areas miles away from the towns!

As practical and immediate steps, however, it was agreed that some amelioration could be obtained by introducing the most strictly controlled approach and take-off patterns and ensuring that all pilots observed them; by utilizing runways which were least likely to cause trouble; by allocating run-up areas away from habitations; and, finally, by educating the public into what is, and what is not, possible in the way of noise control in such circumstances.

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THIS discussion was, of course, directly linked to the question of safety around airports, and therefore had a topical association with the closing of Newark as a result of three bad crashes around that field. Noise and fear are intimately connected, one aggravating the other, and the cumulative effect of these three accidents plus one (non-fatal) at La Guardia, and one severe one near Idlewild, resulted in a wave of local hysteria which was quite out of proportion to the issues involved. The situation was undoubtedly encouraged by those with political, business, or ideological axes to grind, and at Newark the outcry did result in the closing of that most important airport and in enormous losses to everyone concerned. It has now been re-opened for military use during daylight hours, but it will be a little time yet before things have quietened down sufficiently for anyone to suggest civil operation again. [November 1st is named in a recent report. —ED.] After the third Newark accident the President appointed a special committee to investigate the situation and suggest remedies. The recommendations of this body are expected soon, but it seems doubtful if they can come up with any answers that aren't already known and being implemented elsewhere by those responsible. It is unfortunate that despite the full inquiries and reports that have been made into these crashes, there still seems to be some feeling in the public mind that the accidents were caused by some deficiency in the airports themselves—which, of course, is nonsense. But from a statistical point of view it is almost incredible that three such accidents could occur around one airfield (more than that, in one *area* near one airfield) in the short time between December 15th and February 11th.

As far as can be ascertained, all three Newark crashes were the result of mechanical troubles on the aircraft involved. First, a C-46 blew a cylinder on take-off, caught fire and failed to get back into the airport; secondly, a Convair fell in a populated area during an instrument approach, perhaps because of engine failure due to icing; thirdly, a DC-6 "lost" both starboard engines after a night take-off, one from causes unstated and one from inadvertent airscrew-reversal. In each case the machine fell among houses, and many people were killed. In the La Guardia accident (which was within the "time pattern" of the others, although there were no casualties), a Convair hit the water during an approach under conditions of poor visibility. In the last and culminating misfortune, at the beginning of April, a C-46, having missed its approach to Idlewild in low cloud, and having been instructed to go round again at 1,500 feet, flew into a residential area not far from the airport.

With such a history within four months, it is hardly surprising that in the New York area there is a bitter hostility to aircraft danger and noise. To quote the law of averages and say it won't happen again is pretty poor consolation for the local populace. One more bad crash into a residential area in New York (or perhaps anywhere else in the United States), and public outcry will jeopardize the very existence of any airport that is near a built-up area.

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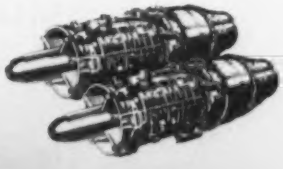
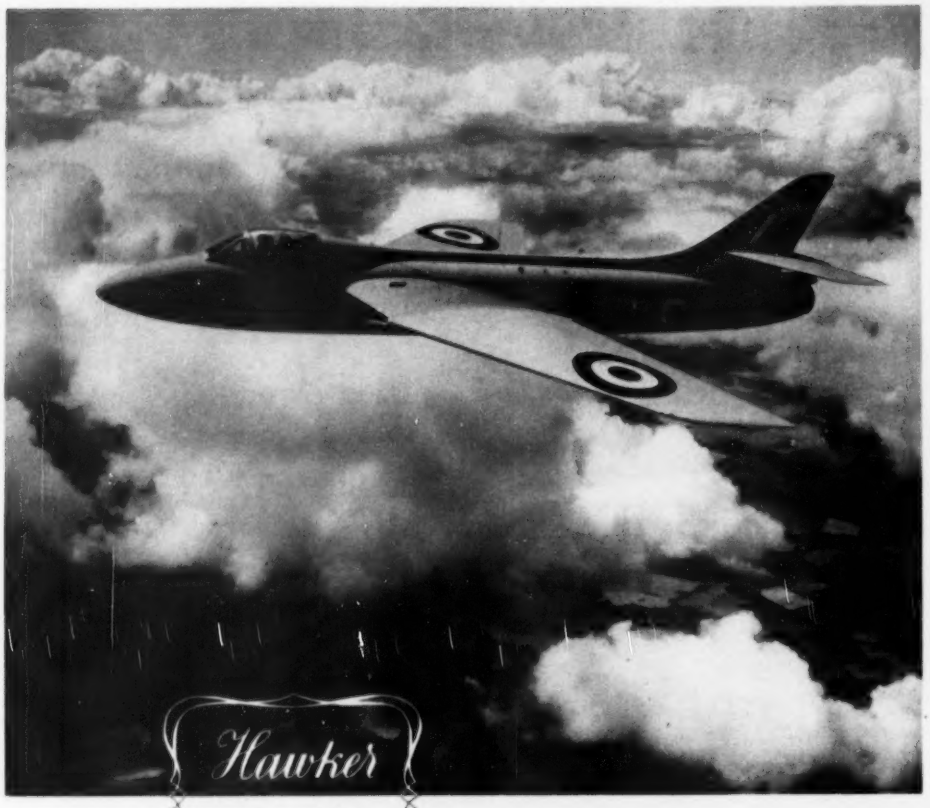
GLOSTER AIRCRAFT

ENGINES BY ARMSTRONG SIDDELEY





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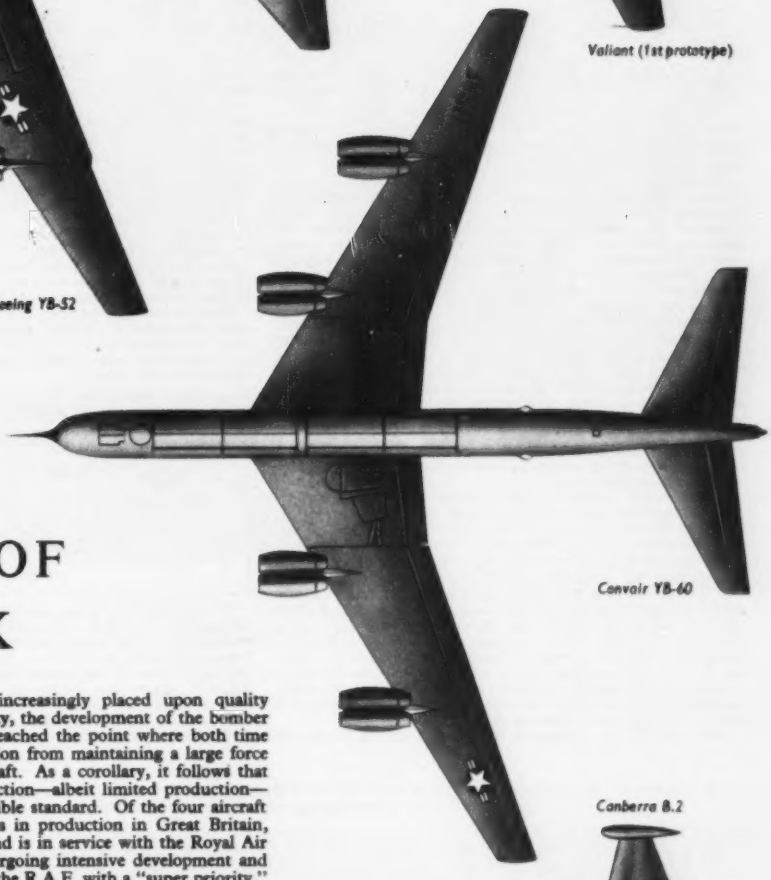
Boeing YB-52

Valiant (1st prototype)

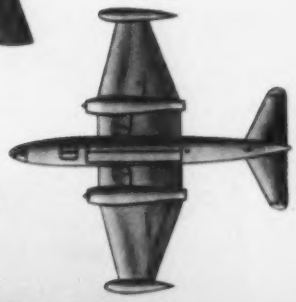


Convair YB-60

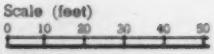
PLANS OF ATTACK

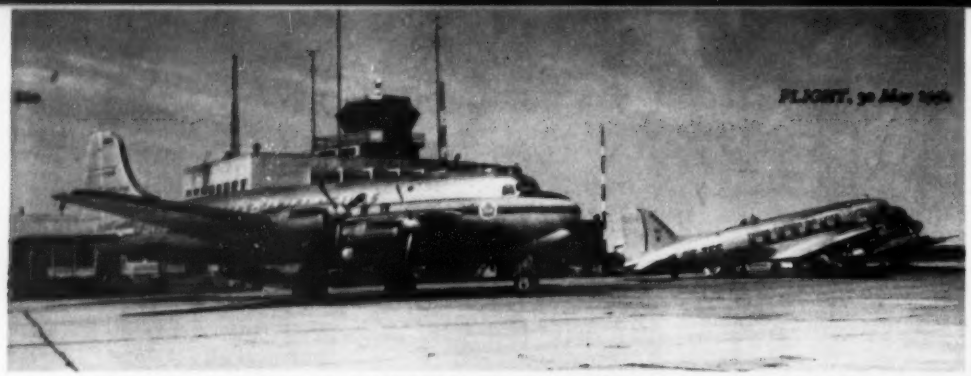
WITH emphasis being increasingly placed upon quality rather than upon quantity, the development of the bomber can be fairly said to have reached the point where both time and money prevent any nation from maintaining a large force of up-to-date offensive aircraft. As a corollary, it follows that the aircraft placed in production—albeit limited production—must be of the highest possible standard. Of the four aircraft shown here, the Canberra is in production in Great Britain, Australia and the U.S.A., and is in service with the Royal Air Force. The Valiant is undergoing intensive development and is going into production for the R.A.F. with a "super priority." The big Boeing—probably the most expensive aircraft ever built—is likely to be built in numbers at Seattle and, possibly, at the Fort Worth plant now used by Convair for the B-36. But the even bigger YB-60 may also be ordered, in which case production at Fort Worth would remain with Convair. Whatever the future may bring—and it will certainly bring even stranger-looking bombers—these aircraft are sure of a most important place in the offensive strength of the Western nations.

Canberra B.2



Scale (feet)





The "Domestic" terminal at Dorval, with a Trans-Canada Air Lines North Star and DC-3 on the apron. Note the tinted glass in the control tower, a necessity in a country where the sun glares down in summer and is reflected from the snow in winter.

TRANSATLANTIC TERMINAL

Dorval—The Famous Wartime Base of Ferry Command as it is Today

AS you fly into Dorval Airport the countryside looks bare and flat, for the airfield lies well clear of Montreal City on the western end of Montreal Island, which is here an almost treeless plain. The approaches to the long runways are clear and well-suited to bringing in or taking off large, heavily loaded airliners.

Before your aircraft arrives you will have been given a large yellow landing card with more intimate—nay, impertinent—questions than you have seen before, together with a two-page Customs' declaration-form designed for resident Canadians and quite impossible for a visitor to complete accurately. The yellow card will be examined by an emigration official, who will correct such statements as "British" to "English" or "Scots," and "Protestant" to "Church of England"! He will demand the length of your stay and give you part of the yellow card, duly stamped with that period and will tell you to guard it with your life as you cannot leave the country without it—when you leave Dorval for Britain there are no Customs, currency or other examinations, and you keep the card. The Customs' officials, or perhaps more correctly *douaniers*, are even less interested in the declaration you have prepared for them, in what you say, or in the contents of your bags, once they have made you open them—nevertheless, you have to wait over half an hour for the privilege of their chalk mark. The whole performance is so completely at variance with the normal Canadian hospitality that it stands out like the proverbial sore thumb.

Dorval today is two airports in one and is a curious mixture. The international airport still centres on the two-storey wooden buildings that once belonged to Ferry Command, while the traffic of the domestic airport is handled in a crescent-shaped, modern-style, terminal building erected in 1941. Anomalies caused by this arrangement are numerous. Although the two terminals are barely a quarter of a mile apart, the road joining them makes a detour round all the maintenance hangars, so that one takes ten minutes, travels over a mile, and expends a dollar of one's scarce allowance on a taxi. Two Customs' staffs have to be retained, because the domestic terminal is used for all flights to and from the U.S.A. This division, now a considerable inconvenience to everyone, arose from the wartime need for keeping civil traffic segregated from the Ferry activities when the new airfield was made from 1,500 acres of swamp in 1941.

Both terminals are inadequate for today's traffic, although just after the war it was thought that the ferry buildings would be derelict—actually the Department of Transport now wishes there were more of them. The modern-looking domestic building, which includes the control tower, is actually the more cramped, while the unpretentious international "sheds" are most effective and of course are wonderfully warm and draught-free to the feelings of a British passenger arriving in winter. On the international side is Dorval Inn, a transit hotel for aircrew and passengers, which was once the personnel building of Ferry Command—in fact your key still carries the brass disc of that unit. Run on Service-mess lines, the inn offers an excellent standard of comfort, but unfortunately the nearby canteen is not open for meals in the evening or at the week-end, so that hungry residents have to make a $2 return trip to the restaurant in the domestic building or endure the crude facilities of the international building's bar (dry).

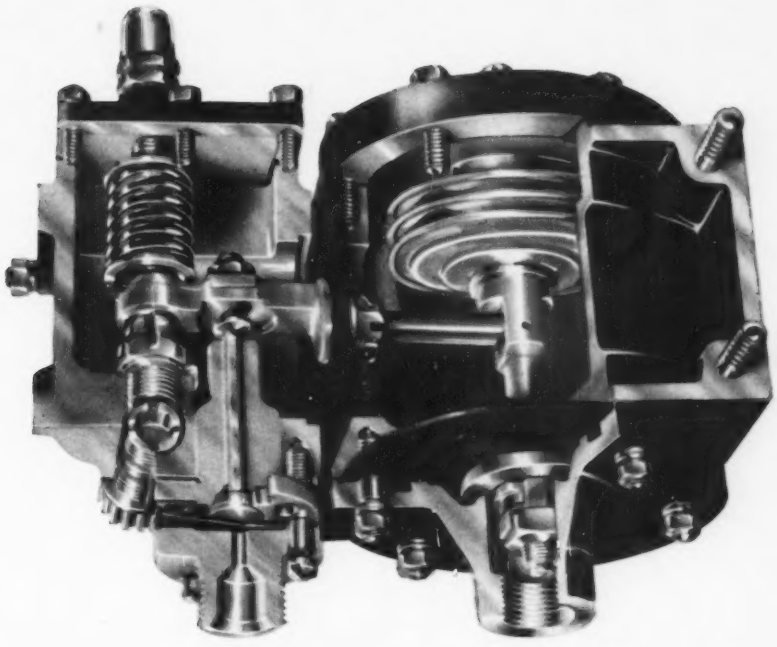
Dorval's origin as the main Atlantic Ferry base—actually it was established when St. Hubert proved too small for the larger aircraft that followed the first Hudson deliveries—is commemorated by a brass plaque in the lobby of the international terminal building. This memorial reads :—

> ***PER ARDUA AD ASTRA***
>
> *This Tablet commemorates the valuable contributions to the War Effort by the following Civil Organisations and Royal Air Force formations based at Dorval.*
>
> | | |
> |---|---|
> | *Canadian Pacific Airlines* | *March 1940—March 1941* |
> | *ATFERO* | *March 1941—July 1941* |
> | *Ferry Command, R.A.F.* | *July 1941—April 1943* |
> | *No. 48 Group, R.A.F.* | *April 1943—February 1946* |
>
> *The Tablet is presented by the Royal Air Force on the disbandment of No. 48 Group, R.A.F., as a tribute to the splendid record of achievement of personnel, both service and civilian, who served on the strength of these Formations.*
>
> **1940—1946**

The airlines that today use Dorval are T.C.A. (domestic and international); C.P.A. (domestic); B.O.A.C. (international); Colonial (U.S.) (domestic); North Eastern (U.S.) (domestic); Air France (international); and K.L.M., who have transit facilities to the West Indies. There are also the flights of No. 410 Squadron, R.C.A.F., and charter and private facilities, so it is not surprising that the peak peace-time operations of nearly 200 per day (last October) exceeded the wartime peak ferry movements.

The hangars which divide the administrative areas are the usual

R.M.A. "Centaurus" and entourage: The convoy of trucks required to prepare a modern airliner is truly remarkable—two Shell refuelling tenders, power-supply truck, Godfrey heating truck, towing tractors and an attendant jeep.



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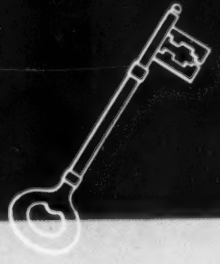

TWO DECADES
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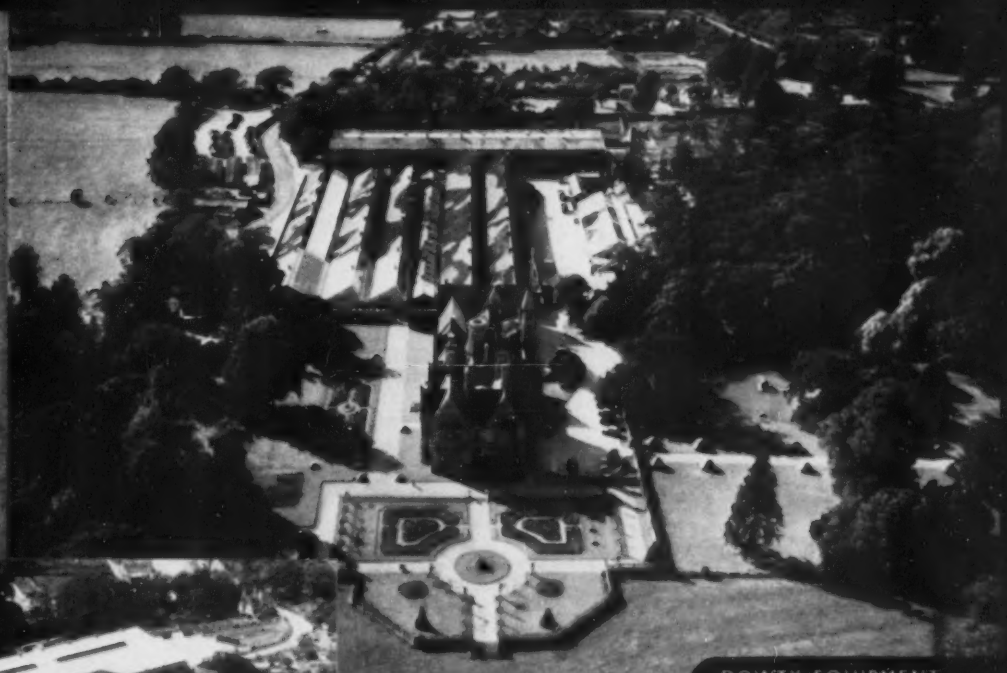

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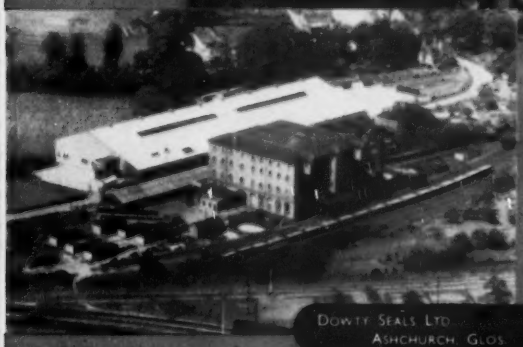

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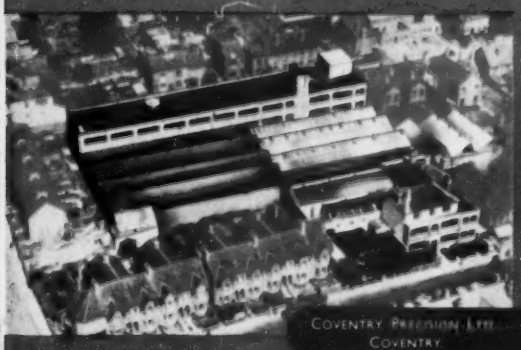

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TRANSATLANTIC TERMINAL . . .

vast four-square, flat-topped buildings of Canada, miraculously heated to 70 deg F in sub-zero conditions and, as always, completely free from draughts. The chief occupants are Trans-Canada Air Lines, who maintain their Canadair North Stars there; the R.C.A.F., whose No. 410 Squadron operate and maintain the North Stars of the Korean Airlift; Canadian-Pacific Airlines; and British Overseas Airways Corporation. There are also some smaller private companies and during the writer's walk through the hangars the Short Sealand demonstrator came to light, being overhauled by Ross-Aero, Ltd.

Between them, T.C.A. and the R.C.A.F. keep the tarmac well populated with North Stars. B.O.A.C., on the other hand, have been bringing in their Stratocruisers three times a week for about two years now—and recently these have, of course, been joined by the tourist Constellations.

The Stratocruiser's huge tail posed a nasty servicing problem to the small B.O.A.C. staff, for it would not go into the standard hangar. In the winter of 1950-51 the difficulty of sub-zero servicing was met by using the "Ifould tower," a tall wooden-wheeled hut that enclosed one engine at a time and allowed two engineers to get to work in a reasonable amount of fug! (This gadget was named after the B.O.A.C. station engineer at Dorval, "Digger" Ifould, who has been with Imperial Airways and B.O.A.C. for 27 years and whose book *Immortal Era* presents a wonderful picture of the inter-war period in civil aviation.) Before last winter, however, an extension (duly stressed for gale and snow) was spliced on to the B.O.A.C. hangar roof and for their turn-round servicing the Strats are now put under cover by running them into the building on special side-tracking skates. Getting the aircraft under cover is a great improvement, but even this does not solve all the difficulties, since, if snow is expected, the airframe has to be cooled off by working with open doors to prevent the snow from freezing on it when it is brought out again.

"Oscar," Trans-Canada Air Lines' Merlin power-plant test truck; it is painted in vivid orange and white squares.

Dorval Inn, one-time personnel building for Ferry Command.

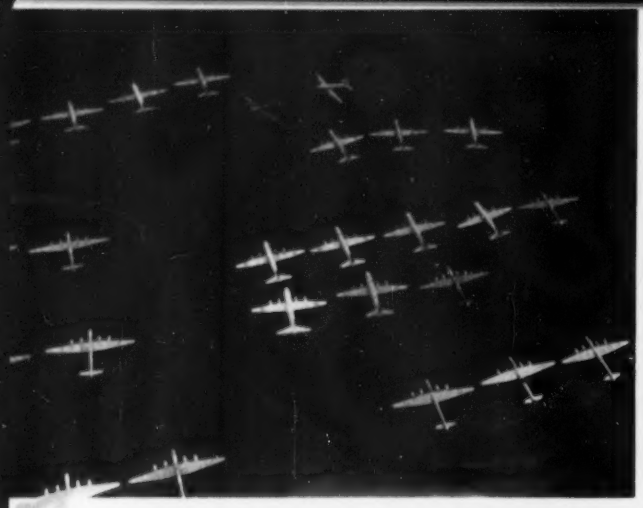
Another Dorval oddity is "Oscar," the mobile test-stand built by T.C.A. for their Rolls-Royce Merlin power plants. "Oscar" is a truck with full test instrumentation and radio for communication with the control tower. It is fitted with tie-down chains and hydrasulically operated steadying feet. The great virtue of this unit is that it can be driven to the far corners of the airport, where noise can bring no complaints, and it can always be headed into wind.

The Montreal traffic-control area is administered by A. V-M. A. de Niverville, but Dorval Airport itself is managed for the Department of Transport by Leigh Capréol, who, apart from being a 1914-1918 Service pilot was the first test pilot of the de Havilland Aircraft of Canada. The services at Dorval include weather radar for rain-searching, together with general weather forecasting for both the domestic and Atlantic areas. Zero-zero weather is very rare and the landing aids are restricted to I.L.S. on two runways, G.C.A. being considered unnecessary. Snow is, of course, one of the main problems. It is generally cleared by snow-blowers, not ploughs. However, with the sun and changes of temperature the runways can become ice-bound and slippery. This trouble is met by freezing sand into the surface. A special coarse river sand is sprinkled on to the runway, followed by a water spray, and this treatment produces a surface that gives good braking and will last three to four hours. The apron is similarly treated, for the safety of passengers on foot. The operation of aircraft under the severe conditions of the Canadian winter is a story in itself, but perhaps these odd points will give some idea of the troubles, quite unknown in this country, that have to be met and overcome by those working at Dorval.

It might be of interest to close this short sketch of Dorval with a note about B.O.A.C.'s own outpost of Empire in the dollar area. Their station manager for Montreal is K. L. Marshall, one-time senior traffic officer at Prestwick; he is based at Dorval, with Geoffrey McDougall (who was Air Marshal Bowhill's aide at Dorval in the Ferry days), as sales manager for Canada in the Laurentian Hotel at Montreal. A tight rein is kept on expenditure, and this has been aided by the great keenness of the personnel, from top to bottom, a virtue that is proved by the small turnover in the staff during the last few years.

In addition to B.O.A.C.'s general office staff and 12 engineers, there is a group of four handling Argonaut spares. Capt. C. S. Kent is operations officer and briefs the Corporation's aircrews. Incidentally, there is a twenty-four-hour service for traffic handling, which is something of an achievement with a small staff; and it is in this work that Eddy MacDonald, the Canadian assistant station manager, proves his worth. A short acquaintance with the B.O.A.C. personnel is quite enough to prove that, if dollars are short, their absence is more than compensated by keenness. Extravagance is far from being rare in airline operation and one can admire thoughtful economies, such as the use of part of the hangar as a store and distribution centre for sales literature, and the subletting of 2,000 sq ft to Lines Brothers as a toy depot. J.H.S.

R.M.A. "Cassiopaea" being side-tracked out of the B.O.A.C. hangar at Dorval. The main wheels are held rigidly at correct track on two dollies running on rails, while the nosewheel is supported on a Skyhi trolley and guided by hand. As with all Stratocruiser towing, a 16-ton tractor is used.



(Left) *A section of the "four-engined" storage park at Aston Down. Hastings and Lincolns are in the majority.*

The tail de-icing strips of a Hastings protected against the continued action of sunlight. Immediately behind the Hastings is a cocooned Spitfire.

AT ASTON DOWN

THE decision to hand over all aircraft-ferrying work from Maintenance Command to Transport Command on June 1st gives special interest to these *Flight* photographs, taken during a visit to Aston Down last week.

Commanded by W/C. F. B. Sutton, D.F.C., R.A.F. Station, Aston Down, Gloucester, houses No. 2 Ferry Pool and No. 1689 Ferry Pool Pilots Training Flight. Since February, 1946, when the task of ferrying was first given to Maintenance Command, pilots from the No. 2 Pool have delivered 14,420 aircraft in 24,517 flying hours and flown over 4,000,000 miles. The Training Flight, which operates a variety of machines, provides conversion training on to the different classes which the student pilots will be required to fly when they join the Pool. All types are included except light trainers and flying-boats. So specialized is the operation of flying-boats that the squadrons do their own ferrying. Even the flying-boat squadrons working with the United Nations forces in the Korean theatre fly their boats back to England when major overhaul becomes necessary.

In addition to the Pool and Training Flight there are also at Aston Down an aircraft storage unit,—No. 20 Maintenance Unit; the Maintenance Command Ground Combat Training School (at present away at Bisley); and a small technical school for training civilian labour employed by Maintenance units throughout No. 41 Group.

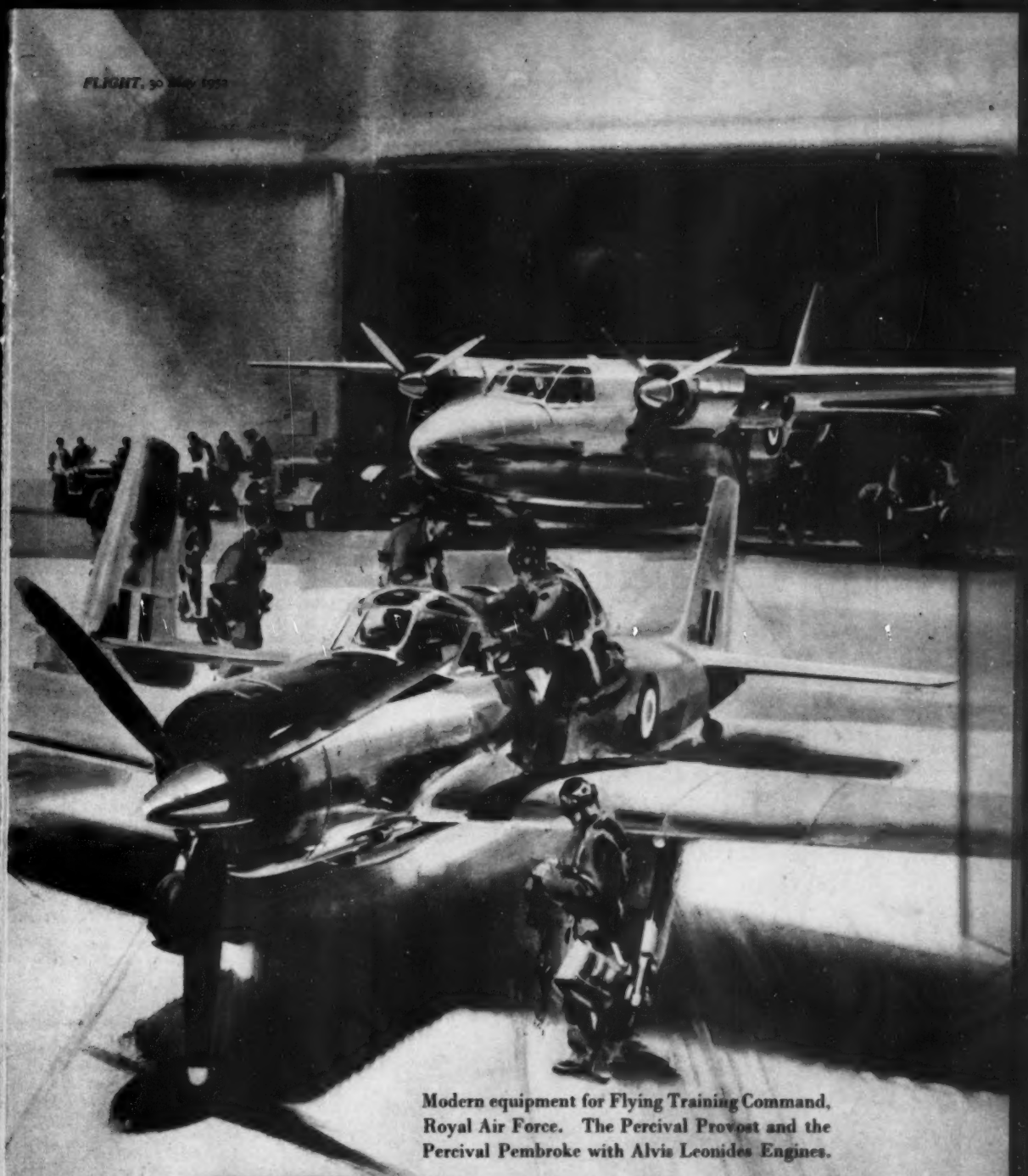
To the Maintenance Unit falls the task of making regular modifications to stored aircraft, thus keeping them up to operational standard before issue or re-issue to squadrons, and servicing all their ancillary equipment. In addition, experiments have been made in the process of cocooning machines; a number of Lincolns and Tempests have been so treated.

"Flight" photographs

In charge at Aston Down: (left to right) S/L. L. C. Clarke, C.O. of No. 1689 F.P.T.F.; S/L. W. R. Middleton, Chief Technical Officer; W/C. F. B. Sutton, D.F.C., Station Commander; and S/L. G. Smythe, who commands No. 2 Ferry Pool.

(Below) *F/L. A. A. Fenn, test pilot to No. 20 Maintenance Unit. The Meteor in the background has made 3,200 landings over a period of three years without requiring the change of a single major component.*

Jobs for the boys: F/L. J. F. Niven, F/L. M. Feldman and Master Pilot G. D. Block peruse their day's duty-sheets.



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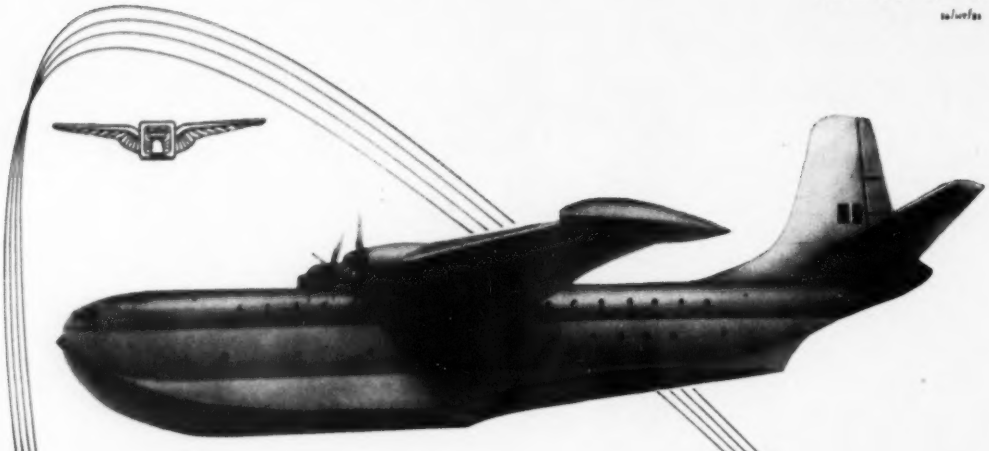
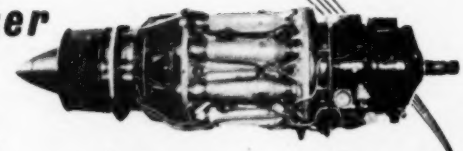
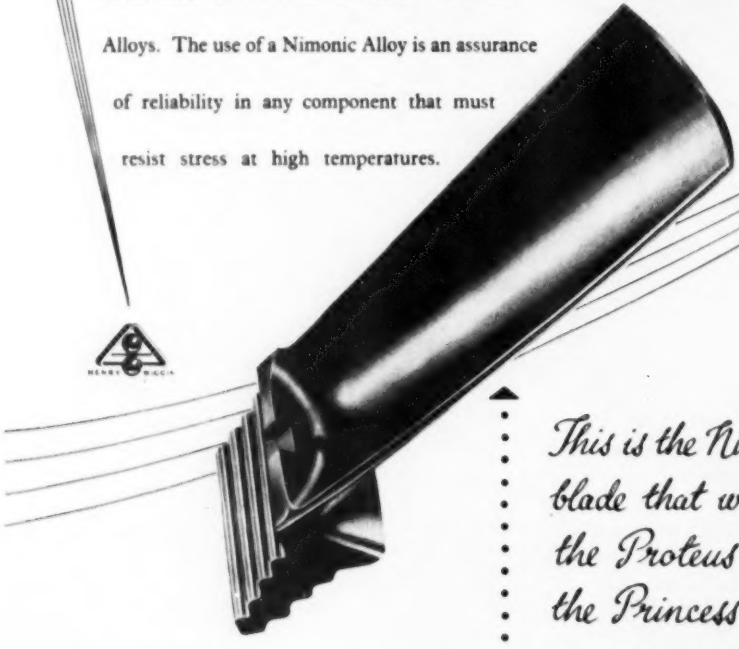


One good trademark leads to another



Every British aircraft gas turbine has rotor blades made of one or another of the Nimonic Alloys. The use of a Nimonic Alloy is an assurance of reliability in any component that must resist stress at high temperatures.

"Bristol"



This is the Nimonic 80 turbine blade that will rotate in the Proteus that will keep the Princess flying

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DOWTY DEEDS

A Classic Among Success Stories, Here First Told

By H. F. KING, M.B.E.

TRULY, the early business history of Mr. George H. Dowty is one of ups and downs and ins and outs; and in so remarking we have in mind not the action of the excellent undercarriage struts bearing his name, but his migrations from a stable-loft to a cellar, and from a Cheltenham villa to a baronial-style mansion. And before explaining this curious behaviour on the part of one who now holds the chairmanship of Dowty Equipment, Ltd., and of ten associated companies; one who has lately been elected President of the Royal Aeronautical Society, and who commands international respect, we may turn back the calendar to the time when he was young George Dowty, a draughtsman in the employ of the British Aerial Transport Company, who were building very good aeroplanes at Willesden Junction.

Mr. George H. Dowty, F.R.Ae.S., chairman and managing director of Dowty Equipment, Ltd., and chairman of its associated companies at home and abroad.

Even in those long-ago days, with the Kaiser's war just over, he had shown a flair for designing undercarriages, and one of his earliest contributions to the art was his work on the B.A.T. F.K.26 five-seater transport of 1919, designed by Mr. Frederick Koolhoven and embodying an internal oleo shock-absorbing system.

With the closing down of B.A.T., George Dowty first secured a post with Avros and later joined Mr. Folland's team at Glosters. By this time it was abundantly clear to him that the accepted undercarriage scheme of rubber shock-absorbers, used in conjunction with a tail-skid, must soon give way to more elegant and efficient solutions, and he was confident that he was just the man to provide them. He recalls how he determined to manufacture his own proprietary undercarriage units in this country, and how, by 1929, he had marshalled his ideas sufficiently to file several patents.

Alas, had pound notes been forthcoming in the same profusion as ideas, the name of Dowty might have soared into the aeronautical firmament there and then; but world depression was at its depth. So to draw attention to his proposals it occurred to him to describe them in the technical Press. Thus, in *The Aircraft Engineer* supplement to *Flight* of April 25th, 1930, we find a neatly illustrated dissertation upon wheels and tyres from the pen of one George H. Dowty, A.F.R.Ae.S., M.I.Ae.Eng., "of the technical staff of the Gloster Aircraft Co., Ltd.", describing current experiments and concluding, "The aircraft engineer will be interested in these results because they definitely show that it is not possible to dispense with hydraulic or mechanical shock absorbers solely by tyre replacements."

It was another article, however, dealing with the now-famous Internally Sprung Wheel, which elicited the first enquiry; and this—not surprisingly, perhaps—bore the letter-heading of the Kawasaki Dockyard Co., Ltd., of Kobe, Japan. Where, it demanded, might the company obtain wheels like those described?

Conscious that a reply from a private address would be hardly worthy of such honourable patronage, Mr. Dowty decided to form a company (which, still being in Gloster's employ, he named Aircraft Components) and to secure an "accommodating address" for the new venture. This last he managed to do through the generosity of a friend. Then he sat down and wrote his reply to Japan.

Having seen this fateful letter duly posted, we may turn aside from our narrative in order to note the technical principle of the wheel which had so captured the oriental imagination. Intended primarily to save drag on high-speed machines, it had been patented during 1929, and, as the name conveys, the oleo cylinder, springs and brake were housed entirely within the disc. Thus, the leg could be made of fine aerodynamic form.

Equally ingenious was the contemporary Parallel-Spring Shock-absorber Strut, and this, likewise, made a really worthwhile contribution to aerodynamic cleanness. It embodied several steel springs, coupled in parallel and arranged co-axially one above the other, and by varying the diameter of the wire from which these springs were formed a load deflection curve identical with that for a compression-rubber or pneumatic system was achieved. The strut diameter was reduced in proportion to the number of spring units incorporated and the clean exterior was easy to fair. In a typical application an appreciable saving in weight, as well as in drag, resulted. In most cases an oil dashpot provided damping. The first installations were made—after some little persuasion by their designer—on the little high-wing Civilian Coupé and a Cierva Autogiro, and the parts were machined on a foot-operated lathe in the cellar of the house in Cheltenham. Turning and fitting were the evening occupation of Mr. Dexter and Mr. Bowstead, who are still with the Dowty organization.

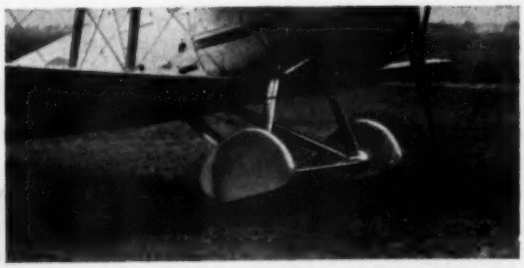
Looking back on those days Mr. Dowty is puzzled how these struts came to be flown, for he was certainly not authorized to issue release notes; indeed, he was probably unaware that such documents existed.

After a few weeks came an answer from Kawasaki, requesting a quotation for six sets of sprung wheels. Then it was that draughtsman Dowty, determined to take on the job himself. And in resigning his position with Glosters he confesses that he met with no great difficulty, for business at that time was by no means brisk, either at Hucclecote or anywhere else in the industry.

Not surprisingly, in view of the unpropitious times, the

On the extreme left are the first factory premises at the back of Lansdown Terrace, Cheltenham (March, 1931). Next, the Grosvenor Place South factory (November, 1932), and, below, the stately Arle Court, upon which the ever-expanding Dowty organization centres today.

Dowty internally sprung wheels on the Kawasaki K.D.5 (Type 92)



The parallel-spring shock-absorber struts of the Gloster Gauntlet.

DOWTY DEEDS . . .

two most pressing items on the agenda of Aircraft Components were: (1) money for raw materials; (2) money to pay for the machining of certain of the larger fittings. The £50 standing to Mr. Dowty's credit at the bank was insufficient even for such a modest venture, and so to a moneylender fell the honour—doubtless unappreciated—of advancing £250 to launch one of Britain's worthiest industrial enterprises.

Obviously these precious funds were not to be squandered; but there was surely no profligacy in the setting aside of 7s 6d a month as the rental of a stable-loft at the back of Lansdown Terrace, Cheltenham, nor in the acquisition, for fifty shillings, of a hand-operated pillar drill, which was duly installed there. Full-time employment, of course, was not to be contemplated, so all the fitting and machinery had to be undertaken by "irregular" labour. Evening after evening the lights burned late in the loft. Improvisation was the rule rather than the exception (thus, plate glass served for surface-plates); but the job went through on time, the wheels were crated and shipped, and the cheque, which arrived in a few weeks, was reckoned to show a fair profit.

Evidently the Kawasaki concern knew a good thing when they saw one, for they lost no time in buying the Japanese manufacturing rights for the sprung wheel for a lump sum of £1,000, and in applying the device to their new K.D.5 (Type 92) biplane fighter. The money was to "come in handy" during the rainy days which followed and which, unfortunately, were to persist for about two years. The bleak prospects notwithstanding, larger premises were procured at Grosvenor Place South, Cheltenham, and small consignments of wheels or struts were delivered to Siam, Poland and Rumania. In an August, 1933, issue of *Flight* we read that Aircraft Components had been approved for design by the Air Ministry, and it was supposed that this was the first time a firm which did not produce complete aircraft had received design-approval. A prototype undercarriage for the Airspeed Ferry proved a "most unprofitable undertaking."

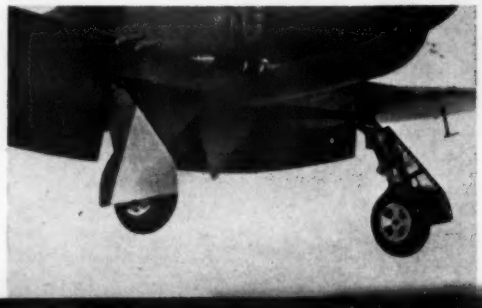
The silver lining which, of course, every real success story must have, showed itself after Mr. Dowty had offered a set of parallel-spring struts for installation on the Gloster Gauntlet, an R.A.F. contract for which was in prospect. Of such an order were the savings in weight and drag that a contract for 25 sets was soon forthcoming, to be followed (as a result of a chance visit to Filton) by another highly acceptable piece of business calling for 250 self-centring tailwheels for the Bristol Bulldog. The need for these had arisen when it was decided that the Bulldogs—already with several years' service behind them—should be fitted with brakes on the main wheels. It was the Bulldog tailwheel, incidentally, which brought Mr. Dowty face to face with the exasperating phenomenon of shimmy, which—as he remarked wryly when we talked with him recently—is not altogether unknown today.

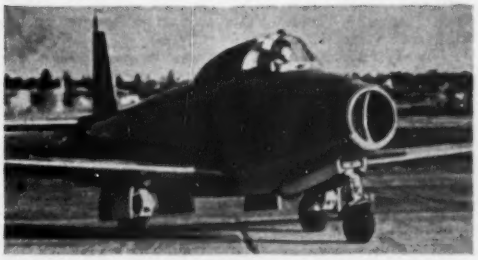
The solution, in the case of the Bulldog, was a friction band with a Ferodo grip, pinched up by a bolt and costing a few pence. Once established in service, the Bulldog-type tailwheel was soon taken up more generally, and before long was to be seen not only on the Gladiator and Gauntlet fighters, but on the civil Airspeed monoplanes. *Flight* gave its blessing in the following terms: "There is a growing tendency in aeronautical engineering to make more use of the specialist designer. It is undoubtedly a good tendency and will help to give us more efficient aircraft. Take, for example, the question of undercarriages. It is obvious that a designer employed in an aircraft factory cannot obtain experience on undercarriages faster than the rate at which his firm produces new machines. Nowadays this seldom means more than two a year. Supposing, however, that man was solely employed upon undercarriages and that he designed not only those for his own firm, but also for many other firms

Gloster Gladiator—first British aircraft with internally sprung wheels.

Boulton Paul Defiant, with Dowty undercarriage and hydraulic system.

The Hawker Tempest, also with Dowty undercarriage and hydraulics.





The historic Gloster/Whittle E.28/39, the world's first successful jet-propelled aircraft, had a Dowty undercarriage and hydraulic system.

The Gloster Meteor 8, like all other marks of Meteor, has a levered-suspension retractable undercarriage and hydraulic system by Dowty.

—as he could easily do if he had no other job—would he not gain experience of undercarriage design faster than he could do by any other method? The result would be that he would have all the idiosyncrasies of undercarriages at his finger-tips, and he would, before long, be able to design the best undercarriage for any particular type of aircraft in a speedy and efficient manner, as he would very soon have a vast store of experience upon which to draw.

"Now, Mr. G. H. Dowty, of Aircraft Components, Ltd., Cheltenham, is in just that position. We have often referred to the undercarriage shock-absorber struts he has designed for various aircraft, and our readers will not be surprised to learn that his struts are finding increasing favour all over the world."

Certainly in the years 1934-35 the staff—now numbering 45 or so—were fully occupied. Dowty undercarriage units were to be seen on F/L. Schofield's Monospar, which won the King's Cup Race of 1934; on the de Havilland Dragon and Tiger Moth (D.H.s to this day are paying royalties on "Tiger" legs); on the Miles Hawk Major, Basil Henderson's Heck and Hobo, the Martin-Baker M.B.1 and the little British Klemm. On the last-named machine near-stalled landings were catered for; in fact, the Dowty equipment generally was so rugged that we find a 1934 issue of *Flight* recording, "It is now quite a common saying among flying people, 'Oh, you just pull the stick back and trust in Mr. Dowty'." But the best-known installation of all (probably because of the striking impression it made on the eye) was that of sprung wheels on the 255 m.p.h. Gloster Gladiator. Less known in this country were similar applications to the Hawker Yugoslav and Spanish Furies.

It was already clear to Mr. Dowty, however, that, in spite of the marked aerodynamic benefits afforded by the sprung wheels, only complete retraction of the undercarriage would permit economical attainment of the high speeds then in prospect. And the first experiments on retracting gear were accordingly put in hand. The principal Dowty innovation in this respect—and one which was to become famous—was the "nutcracker" strut, the function of which was to provide a member which would form a rigid bracing for the compression leg when the undercarriage was extended and, at the same time, embody a retracting mechanism complete—except for its power source—in a self-contained unit.

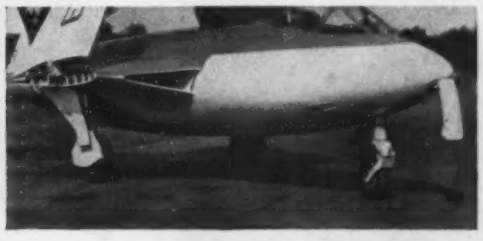
The first installation of hydraulic retraction was an historic one, the machine being none other than the Bristol 142 *Britain First*, designed to embody the Dowty nutcracker strut. The novelty of the installation naturally attracted a continuous stream of privileged visitors and all requested a demonstration with such politeness (or, alternatively, authority) that refusal was out of the question. Retraction was effected by means of a hand pump, so while these performances proved an excellent means of muscular development, they were hardly appropriate to the flashing performance predicted for *Britain First*; thus it was decreed that a hydraulic pump should be installed. Provision of this fitment was by no means the off-the-shelf transaction it would be today. True, only two things were lacking; but these happened to be the pump itself and a suitable drive, and, as the Bristol Mercury engines did not afford the latter facility, it was evident that electrical power must be introduced. This was done, and *Britain First* got her labour-saving hydraulic system. Complete success did not immediately follow, though this was due not to any human shortcoming, but to the fact that the hog's-belly leather hastily procured for packing the seals had originated on a porker afflicted with (natural delicacy almost forbids the word)—pimples.

And as with undercarriages, so with flaps, as witness the announcement during June, 1935, that at least twenty types of aeroplane in this country and on the Continent were employing Dowty flap-operating equipment. Essential parts of the system were the hand-operated pump, control valve and jacks. The maximum flap-load was limited by a release valve and at any pre-determined load this would open, by-passing the oil to the reservoir, so that the flap folded into the wing. A complete set of this flap-control gear for a 9,000-lb machine weighed a mere 10 lb.

It was in 1935 that the efforts of Mr. A. W. Martyn, who had joined the board as chairman, secured the mansion of Arle Court, standing with picturesque serenity in 60 acres of parkland two miles out of Cheltenham on the Gloucester road. The staff of 59 moved in, and that they soon proved worthy of their surroundings is shown by the figure of £10 million standing on the order-book only four years later.

But we are anticipating, and must resume our account at the year 1937. By that time the actuation by hydraulic jacks of retractable undercarriages, tailwheels, flaps, gun turrets, gun-firing gear, bomb doors, trim tabs and cooling gills, had been generally adopted by British constructors. *Flight* pointed out that the hydraulic system offered a very simple means of gearing up or down between the power unit and the final operating device, for it was only necessary to vary the piston areas of the units in order to give the desired effect. The particular system was extremely simple, and for emergency lowering of the undercarriage (in the event of failure of the hydraulic system, due to damage by gun-fire or other causes) compressed air, stored in a small container or in one of the undercarriage members, was released into the jack by means of a valve which could be actuated by remote control.

Two of our latest Naval aircraft, the Westland Wyvern strike fighter (left) and the Hawker Sea Hawk intercepter (right), have a Dowty retractable undercarriage, with Liquid-Spring shock absorbers, and a hydraulic system of the same make.



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Another innovation at this time was an ingenious little electro-mechanical indicator which told the pilot at a glance the position of the undercarriage and tailwheel, and the angle of the flaps. Coloured lights indicated when the components were fully locked home.

While the well-established undercarriage systems and components gained ever widening acceptance in this and other countries (the sprung wheels of the Westland Lysander instantly come to mind), new ideas reached fruition in the period 1937-38, the most notable of them being the principle of levered suspension. In one arrangement an intermediate-pressure tyre and wheel unit was supplied complete with brakes and built-in oleo-pneumatic shock-absorber. Four designs were available, covering all sizes of aircraft weighing between 6,000 lb and 24,000 lb, and each size of hub could be provided with a standard brake and shock-absorber to accommodate different weights. Characteristics of the springing mechanism could readily be varied by adjusting the vertical wheel travel and changing the shock-absorber inflation pressure. The wheel was a direct development of the high-pressure internally sprung wheel already mentioned. Springing was oleo-pneumatic and impact loads were no longer dissipated by the conventional telescopic type of shock-absorber strut, but by a pin-jointed oleo-pneumatic shock-absorber free from bending and racking loads. Flight testing was carried out on a D.H.89 and the experimental installation is shown in an accompanying photograph.

The now-famous levered-suspension principle arose from the company's analysis of the normal telescopic compression-leg, which had the drawback that it was impossible to position so that all combinations of vertical and side loads induced by drift-landings, and drag loads due to braking, gave a resultant load which was truly axial to the shock-absorber. This meant that the strut was subjected to bending, resulting in a deflection, from which arose a binding action. Essentially the arrangement consisted of pin-jointing a shock-absorber to a beam or lever which carried the wheel. The legs, as distinct from the telescopic compression-legs, were purely structural members to which were attached the swinging levers forming the mounting for the wheel. The shock-absorbers were attached to the levers, and to the legs, through pin-joints, and controlled the movement of the wheel. Under the action of vertical loads the wheel swung about the pivot bearing, thus compressing the shock-absorber, and drag loads (which also had a moment about the pivot bearing) resulted in the same movement. So the energy absorption characteristics of the undercarriage were utilized for both vertical and drag loads.

Among the experimental installations of 1938 was a track-type undercarriage on a Lysander. With this in place the "Lizzie" was taxied at 70 m.p.h., but before take-off and landing tests could be made the work was stopped. The American authorities, however, have proceeded with development work until the present day.

The first American machine equipped with the new gear was a Fairchild monoplane; the second, a Douglas Boston. Some hundreds of landings were made with this Dowty gear, in addition to high-speed taxying and the negotiation of obstacles up to 9in square at high speed. Tests were also made on mud and sand, wherein the standard nosewheel buried itself completely, while the tracks remained on the surface.

The track gear for the Boston was designed with a low ground-contact pressure but, in an article contributed to *Flight* in 1943, Mr. Dowty expressed the feeling that future development would be for higher contact pressures, suitable for concrete runways. He believed that a track offered the greatest advantages on aircraft of 100,000 lb gross weight and over, and concluded, "The results of tests so far conducted indicate that improvements can be made on future designs. The successful result obtained with the Boston tracks is undoubtedly a pointer as to the form of the large undercarriage of the future."

Here it may be remarked that, even before the establishment of the Dowty Corporation of New York in 1940, Mr. Dowty's ideas were not unfamiliar to American aircraft constructors. One of our pictures shows an oleo-pneumatic undercarriage installation on the Ryan S.C. cabin monoplane of 1939, during which year Mr. Dowty called on several American manufacturers. Four of these were later to secure Dowty licences.

At home business was continuing to increase as the Royal Air Force expansion scheme gained impetus. Hurricanes, Lysanders, Ansons, Hampdens, Stirlings—all were Dowty-equipped, while on the civil side the Heston Phoenix and several de Havilland types, including the Albatross, Rapide and T.K.4 appeared on the ever-lengthening schedule of types. Much of the experimental work was naturally confidential, but at the 1939 Garden Party of the Royal Aeronautical Society the company was authorized to show, as a working exhibit, "a large retractable undercarriage intended for a medium bomber."

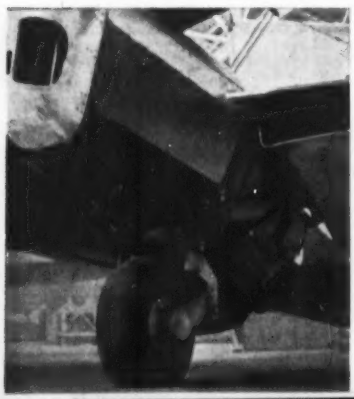
At this time the limitations of simple gear-type hydraulic pumps had become obvious, and for high pressures it was necessary to turn from gear-wheels to the solid-displacement principle. The outcome was the "Live-Line" pump, of multi-piston type and made in a variety of patterns, giving various deliveries.

By 1939 Dowtys were marketing, in addition to these pumps, the components necessary for all types of aircraft hydraulic systems, including selector and control valves, filters, automatic cut-outs, reservoirs, jacks and hand pumps.

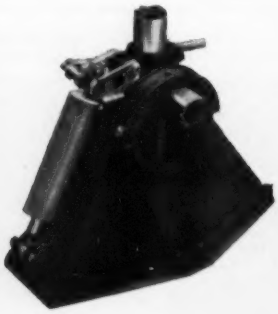
The outbreak of war necessitated further large increases in plant and facilities and in October of 1939, the Canadian branch of the company was formed. Production in England soared to yet dizzier heights. Salvage, repair and maintenance departments were set up, and a school was opened, under the aegis of R.A.F. Technical Training Command, for the instruction of R.A.F. personnel in maintaining and servicing hydraulic systems and undercarriages. Here the actual Dowty equipment as installed in the Hampden, Hurricane, Typhoon, Lancaster and other Service types was set out. Even the skylights of the classroom—originally opened laboriously by hand—were fitted up with Dowty hydraulic jacks, and proof of the trainees' appreciation of the facilities and comfort afforded was to be found in the visitor's book, wherein one entry read: "A really 'live-line' course with constant 'high delivery.' A pity to have to 'cut out' so soon."

The levered-suspension principle, of which we have already taken note, was to find an historic application on the

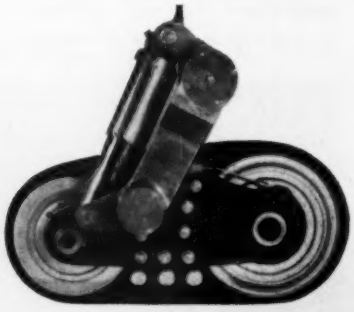
Experimental undercarriage on D.H.89.



Experimental ski mounting for Gladiator.



Experimental track-type undercarriage.



De Havilland Tiger Moth, with Dowty shock-absorber legs.

Double retractable tailwheels on the Short Stirling.

Ryan S.C. monoplane, with experimental levered-suspension undercarriage

(Above) Internally sprung wheels on Westland Lysander. (Below) the Dowty-equipped Avro Canada Jetliner. (Right) Avro Lancaster with Dowty retractable undercarriage and hydraulic system.

Bristol "Britain First," with early Dowty retractable undercarriage

jet-propelled Gloster/Whittle E.28/39 of 1941. The low ground-clearance permitted by the absence of an airscrew allowed full advantage to be taken of the inherent compactness of the system, and results were altogether successful—so much so, in fact, that a generally similar undercarriage was chosen for the Meteor. The Meteor embodied another Dowty innovation in that the main legs were compressed on retraction in order to lessen the space needed for stowage.

An occasion of note during 1943 was an exhibition at the headquarters of the Ministry of Aircraft Production, wherein the track undercarriage and liquid-sprung shock-absorber were first shown publicly. *Flight's* representative was much taken by the Liquid Spring system and wrote of it, "It is so much a departure from commonly held postulates that we could scarcely believe the device workable, flatly refuting, as it does, the generally accepted principle that oil is, for all practical purposes, incompressible."

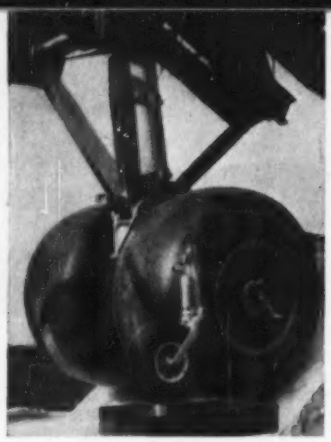
The unit consisted of a cylinder in which slid a piston rod carrying a head, itself containing a damping valve and orifice. With the rod fully extended the cylinder was completely filled with oil, to the exclusion of all air; so, when the rod was driven into the cylinder the reducton of volume caused by the presence of the rod induced compression of the fluid. Very little maintenance was necessary. For topping-up there were two filler plugs whereby oil could be introduced without air. Eloquent of the system's robustness were the results achieved on a Halifax, which survived two crash-landings and was then subjected to 500 landings without receiving attention of any kind.

The Liquid Spring, of course, has grown vastly in popularity since 1943, and is now installed on many of the most advanced types of civil and military aircraft.

With the ending of the war Dowty technical development went from strength to strength; thus, Mr. A. W. Martyn, the chairman, addressing the annual general meeting at Cheltenham in 1946 was able to announce : "At no time in our history have we had so large a volume of prototype and development work. We are working concurrently on such designs as the Bristol Brabazon, Bristol Wayfarer, Avro Tudor, Airspeed Ambassador, and numerous other civil and military types."

The Brabazon undercarriage itself was a major achievement. On the Mk 1 machine the principal units are two main Dowty assemblies, with liquid-sprung shock-absorber units and two twin-tyre Dunlop wheels; a Dowty nosewheel assembly, also liquid-sprung, with twin steerable Dunlop wheels; and a non-retractable tail bumper, again with liquid springing. On the Mk 2 there will be two main undercarriage groups of four-wheel bogies, each with Dunlop twin-tyred wheels, and this gear is now to be seen on the massive 100-ton drop-test rig at Arle Court.

Dowty's know-how, acquired during years of work on



R. H. Bound, F.R.Ae.S., technical director, Dowty Equipment, Ltd., and director of Group Companies.

B. A. Duncan, O.B.E., Whit. Ex., F.R.Ae.S., director, Dowty Equipment, Ltd., and Group Companies.

E. Nicholl, B.Sc., Eng. director and chief designer, Dowty Equipment, Ltd.

(Left) The original undercarriage for the Bristol Brabazon compared with one of the main-wheel units of the Fokker Promoter.

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hydraulic pumps, has stood them in good stead in their post-war development of turbojet fuel pumps, for which their name is already established. One of them, developed for the Goblin, was the first of its kind to carry out a 500-hr non-stop test on petrol without lubricant in either fuel or pump.

Nor has the company's post-war interest in power-plant accessories been limited to these pumps, for at the Farnborough Display of 1948 they showed an entirely new development in the form of spill burners and fuel galleries for gas turbines. The prime feature of the new burner was that the degree of fuel atomization remained constant irrespective of fluctuation in fuel feed. This system is now in production at two Dowty factories—those of New Mendip Engineering, Ltd., at Melksham, and Coventry Precision, Ltd., Coventry.

Synthetic-rubber seals are another post-war development and the "Strud" is a leak-proof bolt for particular application to integral wing tanks and pressurized cabins. It is used extensively on the Comet. Then there is the range of electrical and electro-hydraulic components such as miniature undercarriage position indicators, warning lights, and push-button, lever, drum and commutator switches. And all the time research goes forward, not only on accessories and components for aircraft, but on hydraulic pit-props, great quantities of which are turned out each month.

Several thousands of people are thus employed in eight factories controlled by ten companies: Dowty Equipment, Ltd., Dowty Mining Equipment, Ltd., Dowty Auto Units, Ltd., Dowty Seals, Ltd., New Mendip Engineering, Ltd., Dowty Fuel Systems, Ltd., Coventry Precision, Ltd., Dowty Equipment of Canada, Ltd., Dowty Corporation U.S.A. and Dowty Equipment (Pty) Ltd., Australia. We name them all to show that the resolute young draughtsman of 1919 has indeed succeeded in working up a "nice little business."

SPECIALIST SUPPLIERS

THE foregoing article will have given some idea of the extent of the field in research, design and manufacture covered by Dowty Equipment, Ltd., and such ramifications necessarily demand the backing of a host of sub-contracting firms, each of whose products may be quite indispensable to a particular item of Dowty equipment.

Some of these suppliers contribute raw material, others supply finished detail assemblies, while the largest group are relied upon for castings, forgings and similar semi-finished work-pieces.

Consideration of these sub-contractors logically starts with the raw material suppliers. Many Dowty products are built up on a main body structure of light alloy; this is true of both the smallest valves and the largest main-undercarriage shock-absorber cylinders. Light-alloy suppliers include Birmetals, Ltd.; High Duty Alloys, Ltd.; Light Metal Forgings, Ltd.; and Northern Aluminium Co., Ltd., who all supply forgings. In addition, Hughes-Johnson Stampings, Ltd., supply light-alloy stampings and Deritend Stamping Co., Ltd., both stampings and forgings. Other light-alloy details come from Sterling Metals, Ltd.

Ferrous-metal suppliers are: Thomas Bolton and Sons, Ltd.; Hadfields, Ltd.; Kayser Ellison and Co., Ltd.; Thos. Headland, Ltd.; Exors. of James Mills, Ltd.; James Nicklin and Co., Ltd.; Frank Stacey and Co., Ltd.; and Swift Levick and Sons, who all supply steel.

Steel bar comes from Brown Bayley's Steel Works, Ltd.; English Steel Corporation, Ltd.; Thomas Firth and John Brown, Ltd.; Firth Vickers Stainless Steels, Ltd.; and W. J. Flather, Ltd. Firth Brown Tools, Ltd., and Hall and Pickles, Ltd., supply special tool steel, while the Diamond Screw and Cotter Co., Ltd., are responsible for the provision of screwed rod.

Steel forgings are the speciality of Smethwick Drop Forgings, Ltd., while other metal suppliers include James Booth and Co., Ltd. (extrusions); the David Brown Foundries Co. (ferrous castings, equivalent to 60-ton steel, for small valves); George Morgan, Ltd. (drop forgings); Sheepbridge Stokes, Ltd. (iron castings, particularly for fuel pump rotors); Smith's Stamping Works, Coventry, Ltd. (stampings); Southern Forge, Ltd. (forgings); Stampings Alliance, Ltd. (stampings); and Ernest B. Westman (iron, for electrical details and solenoids).

Dowty products make use of much precision tubing, supplied by Accles and Pollock, Ltd.; Chesterfield Tube Co., Ltd.; Reynolds Tube Co., Ltd.; and Tubes, Ltd.

Rather-more-finished parts come from Brooke Tool Manufacturing Co., Ltd. (machined details); Manganeze Bronze and Brass Co., Ltd. (bronze and brass details); Nettlefolds, Ltd. (small metal details); and J. Stone and Co., Ltd. (non-ferrous machined details).

There is hardly a single Dowty assembly (apart from the liquid-spring legs, of course) which does not contain a spring somewhere; the various types used are made by the Dart Spring Co., Ltd.; F. S. Ratcliffe and Co., Ltd.; Robert Riley, Ltd.; George Salter and Co., Ltd.; H. Terry and Sons, Ltd.; and Warren James and Co.

Wire comes from Spencer Wire Co., Ltd., and piping from Tungum Sales, Ltd. Numerous pumps and actuators require ball, and other, bearings; these are obtained from British Timken, Ltd.; Hoffman Manufacturing Co.; Ransome and Marles, Ltd.; and Skefko Ball Bearing Co., Ltd.

Performing an essential, if unspectacular, service are Monochrome, Ltd. (plating) and Flexcol, Ltd. (nickel and chrome plating).

Hydraulic jacks, main-undercarriage shock-absorbers and even some pumps, all require the provision of suitable piston rings; this need is met by the British Piston Ring Co., Ltd.; Hepworth and Grandage, Ltd.; and the Wellworthy Piston Ring Co., Ltd. A somewhat similar requirement is the supply of shaft seals and other hydraulic gasket assemblies; the principal suppliers of seals to Dowtys are Coopers Mechanical Joints, Ltd.; Flexibox, Ltd.; Super Oil Seals and Gaskets, Ltd.; and Ronald Trist and Co., Ltd.

Small A.G.S. parts are needed in every type of Dowty product; great numbers are supplied by Brown Brothers (Aircraft), Ltd.; Guest, Keen and Nettlefolds, Ltd.; and Linread, Ltd. Hard-wearing laminated-fabric details—required for plunger rings, brake-blocks and some electrical assemblies—are supplied by British Belting and Asbestos, Ltd.; Ferodo, Ltd.; and Tufnol, Ltd.

Other suppliers of special items are Balner Metal Stopper Co., Ltd. (dust caps); Negretti and Zambra, Ltd. (instruments and gauges); Payne and Griffiths, Ltd. (oil level windows); the Plessey Co., Ltd. (electrical details); Tecalemit, Ltd. (lubrication details); Teddington Controls, Ltd. (remote-control equipment); and Vokes, Ltd. (filters). For Dowty undercarriage units, the Dunlop Rubber Co., Ltd., supply complete tyre, wheel and brake assemblies.

Alfred Herbert, Ltd., are named as the principal suppliers of machine tools to the Dowty factory. Some machining is farmed out to sub-contractors, however, and both machining and assembly is carried out on Dowtys behalf by Parnall (Yate), Ltd.; Wildt and Co., Ltd.; and Williams and James (Engineers), Ltd.—while the complete machining and assembly of the Live-Line pump equipment is handled by Air Service Training, Ltd.

Finally, to set the hall-mark of excellence on the finished products, Dowty nameplates are made by British Metal Engraving Co., Ltd.; London Nameplate Manufacturing Co., Ltd.; and (transfer labels) Dowsett Edge Co.

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22

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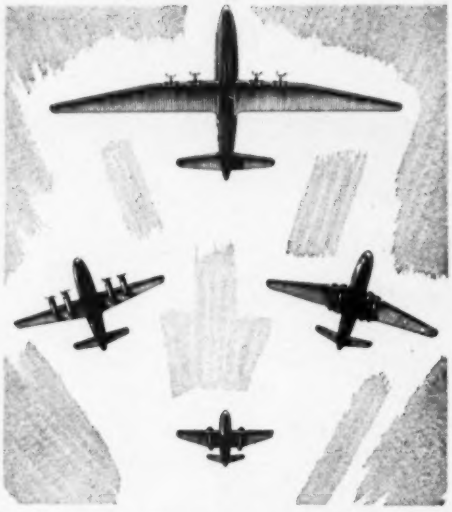

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RARE VISITOR to London Airport last week was this DC-4 of Australian National Airways, which "stood in" for the two similar aircraft (both undergoing overhaul) normally operated on behalf of Air Ceylon by A.N.A.

CIVIL AVIATION

GOVERNMENT'S CIVIL POLICY

THE Minister of Civil Aviation was expected to announce on Tuesday the Government's plans for increasing the opportunities open to independent operators. Inevitably, the policy was expected to strike a compromise between the natural desire of the Corporations to retain their more profitable services and the independents' anxiety to enlarge and secure the present basis of their operations. Another factor affecting the Government's decision was the potential use of independents' aircraft as a transport-reserve for the R.A.F.

NEW CANADAIR TRANSPORT

A PROVISIONAL specification has been issued of the new Canadair CL-21 twin-engined transport; the company is surveying the reactions of airline operators to its initial proposals. Details are as follows: two engines of 1,500-1,700 h.p. (reported to be Wright Cyclone 9 Series HE); pressurized fuselage seating 32 passengers; cruising speed, 220 m.p.h.; block speeds between 145 and over 200 m.p.h.; stalling speed, 74 m.p.h.; fuel capacity, 500-750 (U.S.) gallons.

U.S. JET-TRANSPORT SUBSIDY

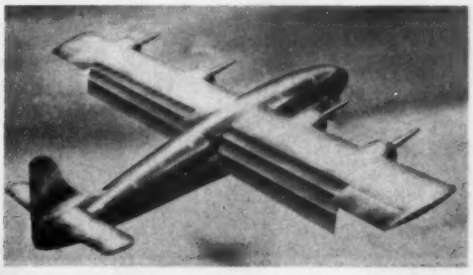
REPORTS from America indicate that the Appropriations Committee of the U.S. House of Representatives may soon be prompted to reverse its recent decision to refuse funds requested by the Civil Aeronautics Administration for construction of one or more jet transports. The change of heart has apparently been prompted by the U.S.A.F., which now regards jet transports as a necessity and favours their development "at any time it can be carried on without interfering with the military programme."

Loans to one or more manufacturers (to be repaid subject to successful production of their designs) of "up to $15 m. [£5,357,000] each" may be made by the autumn if, as expected, Congress approves the subsidy plan. Even so, it has been estimated that at least two years will elapse before a prototype U.S. jet airliner is ready for flight-testing.

FUEL SHORTAGE CONTINUES

ALTHOUGH nearly all the 90,000 U.S. oil workers involved in the wage-dispute which has disrupted world airline services will probably have returned to the refineries by the time these words appear, the cumulative effect of the strike is unlikely to have diminished. B.E.A.'s scheduled services were reduced by nearly 50 per cent last week, while B.O.A.C. cut Far East and "luxury" transatlantic services by one-third in order to maintain all its scheduled "Mayflower" (low-fare) services on the North Atlantic. The Corporations, naturally enough, are seriously perturbed by the effect which the fuel-shortage will have on financial results at a time when both are making supreme efforts to run at a profit.

Great concern was also expressed by the British Independent Air Transport Association, which protested that the "crude method" of applying the restriction bore most hardly on its members. After receiving a B.I.A.T.A. deputation on May 20th, Mr. Reginald Maudling, Parliamentary Secretary to the M.C.A., undertook "as a matter of urgency" to examine various possibilities of altering the basis of rationing. There was a further meeting the next day, attended by Government, B.O.A.C., B.E.A., oil company and B.I.A.T.A. representatives, at which it was decided to make three concessions to ease the lot of the independents; briefly, these were that: (i) Companies operating international services could, by agreement draw on one another's fuel allocations overseas; (ii) The Channel Islands would no longer be regarded as an area separate from the remainder of the U.K. for the purposes of fuel rationing; (iii) Realizing that, proportionately, the independents would suffer more than the Corporations during May and June if their fuel deliveries were based on April requirements, the M.C.A. may authorize increases in deliveries.



LOUIS BREGUET has produced design-studies for an airliner which, with a speed-range of 50-185 m.p.h. and 3,000-10,000 lb. payload, is a potential competitor for B.E.A.'s proposed London-Paris helicopters. This impression of the Bréguet 941, as it is designated, shows the tilting airscrews and triple flaps which are intended to give exceptionally short take-off and landing runs. The engines specified are four 800 h.p. radials.

B.O.A.C. HERMES MISHAP

FOR reasons so far unexplained, a B.O.A.C. Hermes IV force-landed hundreds of miles off track in French West Africa on Monday while *en route* from Tripoli to Lagos. The landing was apparently made in soft sand, with damage to the port wing, some 300 miles N.W. of Dakar and 90 miles S.S.E. of Atar. The ten passengers and crew of eight were believed to have escaped injury.

BAHAMAS REORGANIZATION

THREE services previously operated by Bahamas Airways (to West Palm Beach, Santiago de Cuba and Havana) are now being taken over by British West Indian Airways. Both companies are, of course, wholly owned subsidiaries of B.O.A.C., and the transfer realizes the forecast of "drastic alterations" in the organization of Bahamas Airways made by Sir Miles Thomas after a recent visit to the Caribbean area. Bahamas Airways, whose losses amounted to some £100,000 during the financial year 1951-52, will continue to operate their outer-island services with Grumman Geese, but their two Dakotas are being transferred to B.W.I.A.

B.O.A.C.'s MIDDLE EAST H.Q.

CHANGES in its Middle East sales organization, as a result of recent developments in air traffic, are announced by B.O.A.C. The area has now been divided into three parts (Cairo and N.E. Africa, the Levant, and Iraq-Persia Gulf), each with its own manager reporting direct to London. The responsibilities of the H.Q. in Cairo are thus divided between the three areas. The Corporation points out that although the Comet service is being operated through Beirut instead of Cairo, the change should not be interpreted as meaning that the H.Q. will move from Cairo. In fact, says B.O.A.C., Cairo will remain an important centre.

FRENCH JET PROJECT

SOME interesting background information on the S.O.60 jet transport design-study (illustrated in model form in *Flight* of April 25th) has been released by the S.N.C.A.S.O. The design-study was completed to specifications for a medium transport laid down by the French Committee for Civil Materials, which was formed last October under the auspices of the Secrétariat Général à l'Aviation Civile et Commerciale. The Committee's programme called for "exploitation of European and North African lines over distances from 400 to 1,900 km [250-1,180 miles] while taking into account the lengths of the available runways." The aircraft envisaged was to have capacity for about 60 passengers and their baggage, i.e. about 12,000 lb of payload.

CIVIL AVIATION . . .

In response to this requirement, S.N.C.A.S.O. has produced studies for three versions of a single basic design : S.O.60A, with three turbojets; S.O.60B, with four turbojets; S.O.60C, with twin main turbojets and two auxiliary jet units. The company comments that "turboprops would seem to be headed for a highly uncertain and far more limited future as compared with turbojets" and that it therefore has not thought it wise to propose a turboprop aircraft.

S.N.C.A.S.O. "particularly recommend" the S.O.60C variant for the following reasons : (1) This type would utilize experience gained in development of the pressurized Bretagne transport both with piston engines and—in more recent experimental form—with Nene and Atar turbojets. (2) Current progress with high-thrust turbojets suggests that this relatively simple design could be developed far beyond the requirements of the initial specification. (3) The S.O.60C would not encroach upon the field at present covered by the Comet, but would appear to be a promising replacement for the Dakota, Convair and Martin type of medium transport. (4) The use of auxiliary jets would permit take-off at full payload from available airfields under a variety of atmospheric conditions, and would solve the problem of installing a third main turbojet. (5) It is the least expensive of the three projects, lying more within the scope of French means and enabling its manufacturers to quote a competitive delivery date.

REARWARD-FACING seats (40, 47, 59 or 68 in number, according to the density required) will be standard fittings in the five ex-B.O.A.C. Hermes IVs to be operated by Airwork, Ltd. The interior shown is that of G-ALDB, first of the Airwork Hermes fleet (which will also be distinctive in using Hercules 773s instead of 763s); this aircraft has just been undergoing tropical trials at Khartoum.

BREVITIES

THE U.K. delegation to the Sixth Assembly of I.C.A.O., which opened in Montreal on May 27th, was led by Mr. J. E. Keel, Under-Secretary in the Ministry of Civil Aviation; he was accompanied by Mr. A. V. Davies, M.B.E., of the M.C.A., and Mr. I. V. Pugh, U.K. alternate representative on the Council of I.C.A.O.

* * *

The S.N.C.A.S.O. concern announces that its S.O. 30P Bretagne with P. and W. R-2800 CA-18 engines (each giving 2,400 h.p. at take-off) has received its C. of A. at a gross weight of 43,000 lb, and that the take-off weight is shortly likely to be increased to 44,590 lb. The original Bretagne, equipped with 2,000 h.p. R-2800 engines, received its C. of A. in September, 1950. Flight tests have been resumed with the Nene-powered S.O 30, which was grounded in September, 1951, for soundproofing and installation of air-conditioning and de-icing systems and auxiliary tanks.

* * *

Flying under charter to the New Zealand Army Department, DC-6s of B.C.P.A. are to make return flights between Sydney and Iwakuni, Japan, each carrying 50 troops to or from Korea. The service between Sydney and New Zealand will be maintained by T.E.A.

* * *

United Air Lines have appointed New Zealand National Airways Corporation as their sales and sales-promotion representatives throughout the South Pacific area, embracing New Zealand and the Fiji, Cook and Western Samoa Islands.

* * *

S.N.C.A.S.O. is to undertake on behalf of the Brazilian V.A.R.I.G. Company the experimental installation of two Turboméca Palas assistance-turbojets in a Curtiss Commando.

* * *

Australia's Department of Civil Aviation is expected to issue shortly an order compelling the installation of rearward-facing seats on all new aircraft on Australian routes.

* * *

Slick Airways, Flying Tiger Line, and U.S. Airlines have asked the U.S. Civil Aeronautics Board for permission to carry airmail, parcel post and express packages, claiming that they could reduce present rates by half. The three airlines, which carry only cargo, serve 45 cities in the United States and between them carry about half of all U.S. air freight. If airmail costs were computed on the basis of carriage in all-cargo planes instead of in passenger aircraft, as at present, they say the rate of 45 cents (about 3s. 3d.) per ton-mile granted to passenger carriers could be reduced by half.

MORE NEW INTERIORS : Scottish Aviation are converting four Aden Airways DC-3s from 26-seaters into "quick-change" versions capable of carrying 32 passengers (as on the left), 40 passengers or 22 plus cargo. On the right is the 40-passenger "tourist" compartment of a Sabena DC-6 used on the North Atlantic route; the same aircraft has a rear cabin for 16 first-class passengers.

FROM THE CLUBS

HIGH, WIDE AND HANSOM: The Minicab 4M in which M. Albert Rebillon set up the four world speed records, mentioned below.

THE London Aeroplane Club is holding a rally on June 14th—as mentioned briefly in *Flight* recently—in collaboration with the Vintage Aeroplane Club and the Herts County Auto and Aero Club. The occasion will be something more than the conventional "At Home," for after lunch the Auto Club members are to stage driving tests around the perimeter track and their efforts will doubtless be critically appraised by members of the Vintage Sports Car Club, who have also been invited.

The flying programme will be an all-day affair, starting with the arrival of the V.A.C. contingent. Various light-hearted events, including a forced-landing competition, will be staged after tea and a handsome cup will be awarded to the highest-placed member of the London Aeroplane Club. Members of the L.A.C. who wish to compete in the H.C.A.A.C. driving tests should contact the Secretary of the Club at Panshanger; meals should also be booked in advance.

Another L.A.C. event, to be held on Friday, June 27th, at Hatfield Club House, is the mid-summer ball. This year, as in the past, the atmosphere will be one of pre-war days. Vintage aircraft and cars are to be parked in the vicinity to add an even greater atmosphere of the "good old days." Tickets, which will include supper, are 12s 6d each and are obtainable from the secretary, Joint Dance Committee, Astwick Manor, Hatfield, Herts. Evening dress will be worn, the swimming pool will be open, and we are informed that "visiting flying machines and horseless carriages should arrive at half-past eight o'clock and will be assisted off the premises at 1 a.m."

DURING April the Strathtay Aero Club logged a total of 133 hr 10 min, despite adverse weather during the early part of the month. Conditions, however, improved towards the latter days and made it possible for three members to be sent on their first solos. Four others completed their Private Pilots' Licence course, and 20 others are making steady progress towards their 30-hour target.

Scottish Flying Club members have been more active at Scone aerodrome in April than for many previous months. It is understood that the Scottish Flying Club expect to resume flying at Renfrew in the very near future, but no doubt S.A.C. Headquarters will attract S.F.C. cross-country fliers and possibly others who have developed a liking for the "wide open spaces" in Perthshire.

THE Vintage Aeroplane Club is to hold a Demonstration Day at Denham tomorrow, May 31st. This event will give owners of vintage machines the chance to show off their aircraft to the best advantage, points being awarded by the judging committee for the best all-round performance. The idea of the competition is not necessarily to provide an opportunity for pilots to engage in an orgy of aerobatics and the strictly "straight-and-level" machines will have an equal chance of winning; it is stressed that a carefully executed circuit and landing will be rewarded by more points than a performance of, for example, badly-controlled aerobatics.

A general meeting will also be held after the competition, beginning at 5.30 p.m., and some points of interest on the agenda will include (a) suggestions for increased activities among non-flying associate members; (b) promotion of an aeromodelling section specializing in vintage models; and (c) the starting of formation flying groups. The entries in the design competition for the Vintage Aeroplane Club badge will also be judged during the meeting.

Those members of the V.A.C. who are considering flying over to Panshanger for the L.A.C. rally on June 14th are encouraged to meet at Denham for lunch and fly over in formation at about 2 p.m.

The Club's Avro Cadet, G-ACHP, is now available for general flying by member pilots holding P.P.L.s, at a charge of £2 per hour.

Incidentally, the V.A.C. has recently lost the services of its hon. treasurer, Mr. Hugh Scrope, in whose place they have welcomed Mr. Harold Blank, of the Airways Aero Club at Denham.

AT the recent conference held at the Ziegenhain gliding site, near Kassel, the president of the German Aero Club Soaring Committee, Seff Kunz, reported that the present membership of the Deutscher Aero Club stood at 31,000; 134 gliders and sailplanes were in operation and 540 members held the German equivalent of Silver Badges.

Although the ban on gliding in Germany was lifted only 12 months ago, the German entry for the World Championships (to be held in Spain during the first two weeks of July) now stands as follows: Ernst Gunther Haase, Miss Hanna Reitsch, Heinz Kensche, Max Beck, Dr. Ernst Frowein, and Seff Kunz (captain). The team will be using three new two-seater Kranich IIIs, an Mu 13 F Bergfalke and a Condor V, in addition to the well-tried single-seat Weihe. A 14-day training camp was due to take place during the first part of this month.

The German National Soaring Competitions will be held from August 3rd to 17th at the Klippeneck site, near Turtlingen, in Wurttemberg; some 25 entries have so far been received.

MORE RECORDS FOR HAYHOW?

FOLLOWING his recent inter-city record-breaking flights, T. W. Hayhow will try to establish a further six point-to-point speed records, three of which will be attempted today, May 30th. Flying his Auster Aiglet Trainer G-AMOS, he will take off from Fair Oaks airfield and fly to Kastrup Airport, Copenhagen. He will try for the London-Copenhagen; Copenhagen-London and London-Copenhagen-London records in Class C.1B (machines of between 1,102 and 2,204 lb weight). A brief stop will be made at Kastrup to refuel. The London-Copenhagen flight involves a distance of approximately 620 miles each way, much of which is over sea.

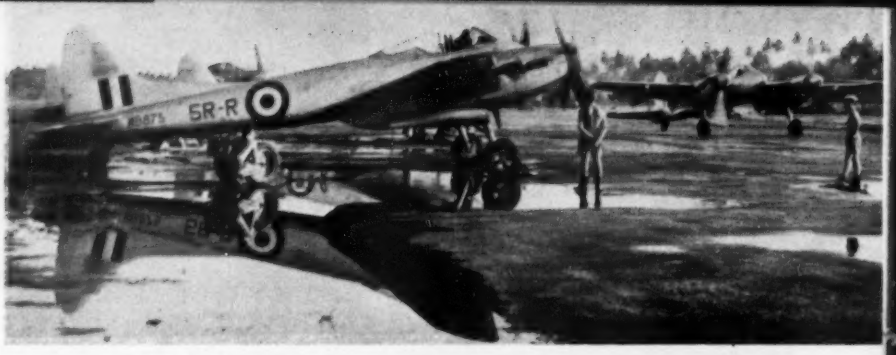
As on previous occasions, the Auster Aiglet will carry a 48-gallon long-range fuel tank in addition to the standard tankage, and a Decca Navigator will be used. The second three record attempts will be between London and Berne, on Saturday, June 7th; these will involve a flight of approximately 470 miles each way.

No light-aeroplane records are at present standing for flights between London and Copenhagen and between London and Berne.

FAST FRENCHMAN

ON May 10th, at Toussus-le-Noble airfield, the French pilot Albert Rebillon set up (subject to confirmation) four new world speed records for aircraft of less than 1,100 lb. Rebillon was flying his privately-owned Minicab 4M—illustrated on this page—in which, a few months ago, he beat the world distance record from Toussus-le-Noble Airfield (Paris) to Rabat-Sale (French Morocco).

RENAISSANCE: Designed before the war for "kit construction" and first flown in 1949, this Heath Parasol is now powered with a 35 h.p. Bristol Cherub—seen here uncowled—in place of the 25 h.p. Blackburne Tomtit at first installed. It is now at Redhill in the keeping of the U.L.A.A., who hope to have it flying again soon. It was built by Mr. R. Parker—then a member of the U.L.A.A. Elstree branch—and originally test-flown by Mr. R. Debenham.



THE RAINS CAME: Hornets at Butterworth, in North Malaya, taxi from dispersal shortly after a tropical rainstorm to take off for an air strike against bandits in South Kedah.

SERVICE AVIATION

Royal Air Force and Naval Aviation News

Royal Example

AFTER the Queen Mother had enjoyed a flight in a Comet last Friday (see p. 651) Her Majesty sent the following happily worded telegram to No. 600 (City of London) Squadron, of which she is the Honorary Air Commodore :—

"I am delighted to tell you that today I took over as first pilot of a Comet aircraft. We exceeded a reading of 0.8 Mach at 40,000 feet. Thoughts turned to 600 Squadron. What the passengers thought I really wouldn't like to say.

Elizabeth R.,
Honorary Air Commodore, 600 Squadron."

On behalf of the officers and men of the unit, S/L. J. Meadows, the C.O., immediately replied :—

"Already excited at news of your Majesty's jet flying. Your Squadron is honoured to have been in your Majesty's thoughts and overwhelmingly proud that their Honorary Air Commodore piloted a jet as high and as fast as any of her Squadron's pilots.—(Sgd.) Meadows, Squadron Leader."

Squadron members will be gratified to know that during this flight Her Majesty was wearing the jewelled No. 600 Squadron badge, presented as a token of affection by personnel of the unit.

Cranwell Memorial Chapel

THE memorial chapel of Royal Air Force College, Cranwell, will be dedicated by the Rt. Revd. The Lord Bishop of Lincoln on Sunday, June 22nd, at 1500 hr.

All relatives and friends of the Cranwellians who gave their lives in the service of the country are invited to attend.

Transport will meet the train arriving at Grantham Station at 1422 hr on the day.

Naval Korean Awards

THE Queen has been graciously pleased to give orders for the following appointments and to approve the following awards for service in operations in Korean waters :

Distinguished Service Order.—Capt. W. L. M. Brown, O.B.E., D.S.C., R.N., and Lt. P. L. Keighley-Peach, R.N.

Distinguished Service Cross.—Lt. (E) H. G. Julian, Lt. C. J. Lavender and Lt. W. Noble—all three are pilots of No. 807 Squadron.

Distinguished Service Medal.—Aircrewmen (I) C. F. Beeton and F. H. Shiel (both of No. 810), Pilot (II) F. E. Bottomley (No. 810) and P. R. Lines (No. 807).

Mentioned in Despatches.—Lt. A. J. Austin, Plt. F. D. Bailey, Lt. D. J. H. Davis, Plt. I. Mackenzie, Lt. G. Y. Temple, Lt. N. R. Williams—all of 17th Carrier Air Group.

Posthumous Mention in Despatches.—Lt. G. H. Coules (No. 810).

Lt. Keighley-Peach was shot down on January 28th, 1951, behind the enemy lines and was picked up by an American helicopter. While down he was completely surrounded by the enemy forces and was rescued under very heavy fire. He was taken immediately to hospital and was flown back to *Theseus* about seven days later, from which time he operated continuously until April, 1951.

In part, his citation reads: "His disregard for his own safety and his determination and spirit has been an inspiration to others. In addition, the accuracy with which he has carried out his attacks has caused great damage to the enemy."

Capt. Brown's award is for outstanding leadership and devotion to duty on many patrols off the coast of Korea, and in particular for his excellent arrangements and command when recovering an enemy Mig aircraft 100 miles behind the enemy front line under conditions of severe hazard on July 20th, 1951. He also showed much initiative and leadership in surveying the Han River under conditions of extreme navigational danger and under enemy fire. Capt. Brown is now in command of R.N.A.S. Lee-on-Solent.

A.O.C.-in-C. M.E.A.F. Takes Over

AFTER having arrived at Port Said by S.S. *Orion* on May 19th, Air Chief Marshal Sir Arthur P. M. Sanders, the new A.O.C.-in-C. M.E.A.F., has left for the first part of a tour of his command. This week he is visiting Cyprus and Iraq, during June he will go to Aden, and in July he will inspect the stations in North Africa and Malta. Khartoum, and R.A.F. units in East Africa, will be visited later.

Australian Award

THE commanding officer of No. 77 Squadron, R.A.A.F., S/L. R. T. Susans, has been awarded the D.S.O. for "outstanding leadership and gallantry." No. 77 Squadron flies Meteors in Korea and this is the first D.S.O. to be won by the Royal Australian Air Force since the war.

Esher Trophy Back in England

AFTER having spent a year north of the Border in the keeping of No. 603 (City of Edinburgh) Squadron, the Esher Trophy has come south again—to No. 616 (South Yorkshire) Squadron, who have been declared the winners for 1951. No. 616 is commanded by S/L. L. H. Casson, D.F.C., and this is the first time the squadron has won the Trophy. In 1950 it was placed third, with No. 604 (County of Middlesex) Squadron in second place—a position now held again by No. 604. Third place for 1951 has been taken by No. 600 (City of London) Squadron, and No. 603 becomes fourth in the list.

The method of marking was based on the hours flown per pilot by day and night, gunnery and the number of instrument ratings held. Sector Commanders awarded marks for operational efficiency and Group Commanders gave them for general efficiency. Freedom from accidents also affected final placings.

The Trophy, revived in 1949 after a lapse of ten years due to the war, was founded 26 years ago by the late Viscount Esher. It is a bronze figure of Perseus, by Sir Alfred Gilbert, standing on a bronze platform and base. Previous holders have

CO-OPERATION: The Army Liaison Officer attached to a Hornet squadron in Malaya, briefs the Commanding Officer (S/L. C. C. F. Cooper) and pilots for an air strike.

CHURCH PARADE : Led by the R.A.F. Band, No. 600 (City of London) Squadron, R.Aux.A.F., are seen arriving at St. Bartholomew-the-Great Church on Sunday last. This is the oldest London parish church, and under an R.A.F. ensign in the Lady Chapel is the squadron's memorial tablet.

been : 1926 and 1928, No. 601 (County of London) Squadron; 1927, 1930-31, 1933-35, No. 605 (County of Warwick) Squadron 1929, No. 602 (City of Glasgow) Squadron; 1932, 1936-37, 1949, No. 604 (County of Middlesex) Squadron; 1950, No. 603 (City of Edinburgh) Squadron.

"Far Horizon"

UNDER the code-name "Far Horizon," Mosquitoes of No. 87 (P.R.) Squadron, Royal Australian Air Force, are at present engaged on a photographic survey of the Fiji Islands area. The task has been undertaken at the request of the Fiji government. The two Mosquitoes employed on the operation flew *via* Tonouta and Noumea to the Fiji base at Nandi. Two Dakotas brought the ground staff and equipment.

For this survey the trimetrogon method is being used. Three cameras, one vertical and the other two at opposite oblique angles are employed—an arrangement by which a very wide coverage can be made.

Indian Auxiliaries

THE Indian Defence Minister, Mr. Gopalaswami Ayyangar, has announced the intention of creating an auxiliary air force. The force will consist of civilian volunteers who will undergo part-time training.

The Bill under which this new organization is being raised foresees also the formation of a regular air force reserve and an air defence reserve. Retired I.A.F. officers will form the regular reserve, and for the air defence reserve a census will be taken of all civilians with aviation knowledge.

N.Z.T.A.F. University Students

TO provide pilots for New Zealand's Territorial Air Force, special training courses are being provided for University undergraduates. During their vacation periods, up to 12 students a year may take the two-year course, at the end of which they will be given commissions in the Territorial Air Force.

R.A.F. Greek Mission Ends

WITHDRAWAL of the Royal Air Force Mission from Greece has ended a seven-year task of rebuilding the Greek armed forces, during which time the Air Ministry has released £6,500,000 of equipment to the Royal Hellenic Air Force. It included 84 Spitfires, 12 Dakotas, 16 Harvards, 12 Tiger Moths and large stocks of aircraft spares, radio and clothing.

At first Britain bore the entire cost of re-arming the Greek forces and the Air Ministry supplied equipment worth more than £3,000,000 to the R.H.A.F. before the U.S. Joint Mission was re-established early in 1947.

Close ties linked the Greek and the British Air Forces after the R.H.A.F.'s emergence as an independent service within a year of Greece's liberation. Even when it was no longer under direct command of the R.A.F. Air Headquarters in Athens, the new Greek Air Force still looked to the R.A.F. Mission—as it had become following the dissolution of the A.H.Q.—for advice on organization, development and training problems.

Internal strife in Greece complicated the R.A.F. Mission's job of creating what was virtually a new Air Force, but it went ahead with the supply of badly needed aircraft and equipment. Spitfires from Britain attacked Communists in their mountain hide-outs, Austers spotted for the Greek National Army's guns in forward areas, Tiger Moths and Oxfords took on R.H.A.F. markings to fly trainee pilots, and Ansons ferried Greek Service chiefs from one mountain front to another.

With the arrival of its United States counterpart in 1947, the R.A.F. Mission's duties were redefined. Both Missions functioned as separate groups under the direction of their own Governments, but were mutually charged with the task of moulding the R.H.A.F. into a vigorous and responsible force. The Air Section of the U.S. Mission advised on matters of supply, works services and operations, and the R.A.F. on organization, maintenance, training and equipment.

In the course of the Mission's work, specialist R.A.F. officers trained Greek Air Force officers and men in the flying, engineering, signals, armament, equipment and organization methods both in Greece and at various R.A.F. schools in the United Kingdom. R.H.A.F. officers toured R.A.F. Maintenance Command Units, the recruiting organization, Royal Observer Corps Headquarters and the Home Office Civil Defence Organization.

As the R.H.A.F. regained its feet, the R.A.F. Mission progressively reduced its staff, which at its peak numbered 250. Before it finally withdrew from the country last month, 10,000 men of the Greek National Army and the R.H.A.F. paid the Mission a ceremonial farewell at which Harvards from a R.H.A.F. training school flew overhead forming the letters "R.A.F."

CARRIER TRIALS : Last Saturday the Parliamentary Secretary of the Admiralty, Cdr. A. H. P. Noble, D.S.O., D.S.C., M.P., and the Civil Lord, Mr. S. W. Digby, M.P., flew from London and landed on H.M.S. "Eagle" to witness flying trials in the Channel. The photograph shows Cdr. Noble (left, profile) and Mr. Digby (in life-jacket) being greeted on arrival. Also attending the trials were the Fifth Sea Lord and Deputy Chief of Naval Staff (Air), Vice-Admiral E. W. Anstice, C.B., C.V.O., and the Vice-Controller (Air) Rear-Admiral E. M. C. Abel Smith, C.B., C.V.O.

L.A.A. Squadrons' Summer Camps

AS a reward for becoming the winners and runners-up respectively of the Lloyds Trophy in 1951, No. 2502 (Ulster) and No. 2602 (City of Glasgow) L.A.A. Squadrons R. Aux.A.F., have been selected to spend their summer camp in Germany. From July 19th to August 2nd they will be in camp on the island of Sylt, off the Schlegswig-Holstein coast. Both units will travel by air and part of the time spent abroad will be devoted to mobile training with aircraft of 2nd T.A.F.

The ten remaining Auxiliary L.A.A. squadrons will spend five of their 14 days summer camp live-firing at the R.A.F. Regiment's L.A.A. Gunnery School at Watchet, Somerset. The other nine days will be employed on exercises between Watchet and their home bases.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Dawn Patrols

I WAS interested to see the note on dawn patrols and similar events in your issue of May 2nd, in which you drew attention to the over-zealousness of some defenders.

I myself had experience of this on one of the patrols you mentioned. Having got through the 3-1 mile zone without a defending aircraft coming near us (as confirmed by my passenger), I flew over the control tower and joined the circuit. Just before turning on final approach, however, with throttle closed and flaps down, we were pounced on by a defender who passed extremely close over us. I mentioned this to a club official after landing, who assured me that the rules were being strictly adhered to; but we found, nevertheless, that we had been recorded as "spotted."

A friend of mine in another aircraft, only a short distance behind us, had exactly the same experience at the same spot.

Although, as you say, dawn and other patrols are mainly informal gatherings of flying types, a visitor does not like having to fork out for a breakfast, lunch or tea which he feels he has won.

Ruislip, Middlesex. H. R. R. BLANK.

Canada's Aircraft Industry and "Enticement"

WE liked James H. Stevens' article in the April 4th issue on "Canada's Aircraft Industry" (Part I).

It is only fair that we should point out, however, that by no means all the engineers who "desert" the Canadian industry are enticed by promises of employment, or promises of bathing beauties, or any promises at all. Some of us had to get our own visas; act as our own sponsors by producing evidence that we had a certain amount in cash or bonds (at the rate of approximately $3,000 for a single person or $6,000 for a couple), and then find our own jobs after crossing the border. Even this is less than half the battle. For an alien to get clearance from the U.S. Government to be allowed to work in aviation—any kind of aviation—or on classified Government work, is about as easy as pushing a camel through the eye of a needle. This security clearance can take over a year.

Some of us—Canadian and English—still like Canada very much indeed; but the difference in salary between a given aircraft job in Canada and the same sort of job in the States, coupled with the fact that living costs are *not* higher in the States (in spite of Mr. Stevens' information) is enough to make us perfectly happy to live this side of the border. It would be fair to add that the King and St. Laurent administrations have also helped some of us to arrive at this decision.

COLIN NICHOLSON, A.F.R.Ae.S.
South Bend, Indiana, U.S.A. DON LONG, A.F.R.Ae.S.

Emigration by Air

SO gratifying a reception has been accorded my views on emigration that I venture to send you a further letter enlarging on some aspects of the matter.

The first point to understand clearly is that by far the most important export we have is British stock. The Board of Trade may juggle with packets of tea, bars of soap, ingots of gold, and ripe bananas and so on to strike a balance—at present adverse—in its ledgers; what it cannot enter as a cash transaction is the value of the future work, the potential influence, and the accumulated know-how of a British subject who decides to take those assets to the Empire.

The reluctance to go rests, in large degree at present, on the belief that emigration means severance from all that is Home. It is a severance imposed chiefly by cost of travel; and that is the factor which must be broken. The Romans, at their rise, saw that only by first-class roads could their dispersed Empire be held together; and the modern analogy is quite simply that we want Roads of the Air to give our Empire an illustrious future linked with a great past.

To make this a reality a statesmanlike approach to the future of our race is needed. On occasions there is vision in Whitehall: for example, imperfect efforts were made with groundnuts in East Africa and chicks in West, so there is hope that the higher civil servants will accept the visionary theory that the true means to foster emigration is by furthering air travel. The Empire Air Mail scheme was one of great vision: it made a silent revolution in communications. On similar lines, were a far-seeing government to introduce a flat fare of, say, £10 to anywhere in the Empire, then the bogey of severance from Home would disappear and the trickle of emigration turn to a flood stream. At today's high cost of travel, emigration to Canada each year averages one person out of every 1,700. If by a modest subsidy, or even by making a surrender value on post-war credits, the Government could raise that figure to only 25 per 1,700 (i.e. only 1.5 per cent of the population), then 750,000 emigrants would be on the wing. Such a pruning of our old wood, and such a grafting on the new wood in the Empire, could not but result in a great new stimulus to the Empire and a healthy trimming of our swollen population here.

London, W.1. B. J. HURREN.

Pioneer Aeronautical Draughtsmen

AS reported in your issue of May 9th, the late Mr. P. M. Jones had an outstanding record as a pioneer among aircraft draughtsmen.

Another pioneer is Albert P. Thurston, now Dr. A. P. Thurston, M.B.E., D.Sc., M.I.Mech.E., F.R.Ae.S., who worked for Sir Hiram Maxim on his aeroplanes. I have seen his beautiful set of finest drawing instruments, with a card enclosed which reads:—

"Presented to Albert P. Thurston by Sir Hiram Maxim, Christmas, 1903, as a small token of his appreciation of Mr. Thurston's skill as a draughtsman and mathematician, and his strict attention to the work entrusted to him.—(Sgd.) Hiram S. Maxim."

Dr. Thurston was the first man to become a Doctor of Science in Aeronautical Engineering at Imperial College, and his work has benefited aviation in many ways. He is a prominent figure in model aircraft circles and the movement owes a good deal to his never-waning enthusiasm and generosity.

East Grinstead, Sussex. J. R. ANDERSON.

[And Dr. Thurston, at over 70 years of age, is still very much in aviation. On May 18th, he flew with others—including Mr. R. Copland, one of his most successful model-flying protégés—in Mr. Rodney Carne's Rapide to Flers, scene of one of the annual Continental air rallies which he makes a point of attending; there they were entertained by the mayor.—Ed.]

IN BRIEF

Commenting on recent discussions of the subject of fatigue in aircraft structures, Mr. K. S. Meakin, of Aero Research, Ltd., Duxford, Cambridge, remarks that spot-welding and riveting processes inevitably concentrate stresses upon focal points, at which fatigue is likely to occur sooner or later. He then goes on to show how such concentrations can be avoided by use of Dr. N. A. de Bruyne's "Redux" bonding process, as used in a number of well-known aircraft, including the Comet. Adding that increasing interest is being shown in the method by constructors abroad, he points out for their information that the registered "Redux" process has been patented by Aero Research, Ltd., in the most important industrial countries; its use is permitted overseas under licence from the company's agents and associates.

FORTHCOMING EVENTS

May 30-June 2. Model-flying team contest, Belgium v Great Britain, Namur.
May 31-June 2. Aéro-Club de Cannes: International Rally.
May 31-June 2. Ailes Sparnaciennes: Champagne Rally.
May 31-June 3. Aéro Club de Roma: Rally.
June 2. S.S.A.F.A.: Air Display, Yeadon, Leeds.
June 2. Midland Aero Club: Display, Elmdon.
June 4-14. Third Mechanical Handling Exhibition, Olympia, London.
June 6-8. Aéro Club d'Italie: Air Circuit of Sicily.
June 7. A.T.A. Association: Flag Dedication, and Reunion, White Waltham.
June 7-8. Yorkshire Aeroplane Club: International Invitation Rally, Sherburn-in-Elmet.
June 8. Royal Naval Flying Club: At Home, R.N. Air Station, Gosport.
June 8. R.A.F. Golfing Society: Match v Air Ministry G.S.
June 14. Girl Guides Association: Air Ranger Flying Pageant, Sywell, Northampton.
June 14. Auster Flying Club: Rally, Roarsby.
June 14. R.A.F.A.: Air Pageant, Sydenham, Belfast.
June 14. London Aeroplane Club, Vintage Aeroplane Club and Herts Auto and Aero Club: At Home, Panshanger.
June 14. Fair Oaks Flying Club, R.A.F.V.R., and London Transport Flying Club: At Home and Display, Fair Oaks.
June 15. R.Ae.S. Garden Party, White Waltham.

Weston Resistance Bulbs

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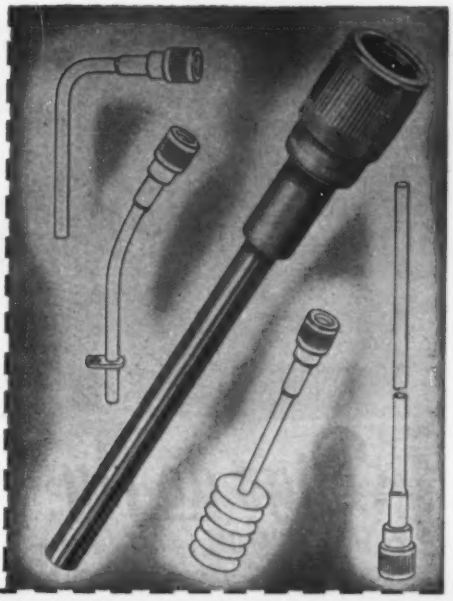

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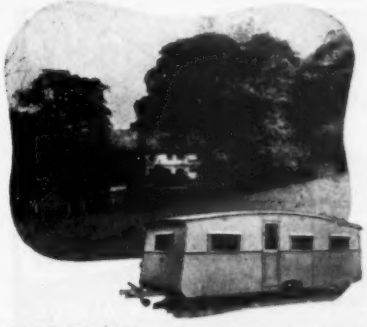

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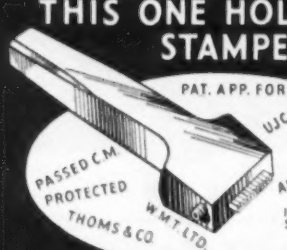

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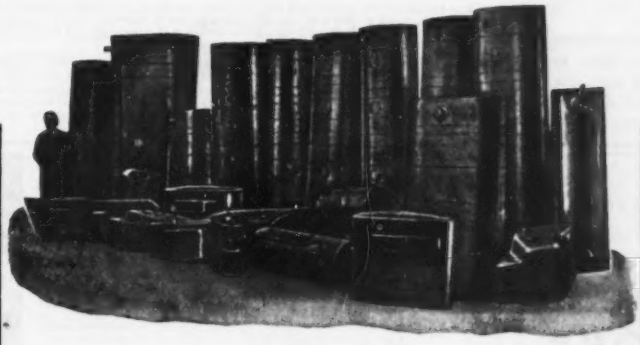

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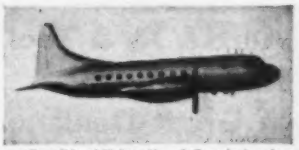

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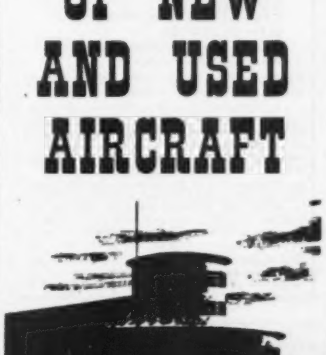

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TECHNICAL authors and illustrators required by Percival Air P/N, Ltd., Luton Airport, Beds. Knowledge of M.o.S. procedure desirable.—Applications, in writing, stating age, experience and salary required, to Manager, Ministry of Labour and National Service, Luton, Beds. [0094]

TEST laboratory assistants (male) required by Percival Aircraft, Ltd., Luton Airport, Beds. National Certificate standard and previous experience on design of test laboratory equipment desirable.—Applications, stating qualifications, experience, age and salary required, to Manager, Employment Exchange, Luton, Beds. [0095]

AIRFORK, Ltd., require navigation instructors for air and ground duties. Desirable qualifications staff navigator course and instructing experience.—Application should be made to the Chief Navigation Instructor, Airwork, Ltd., Usworth Aerodrome, Castletown, Nr. Sunderland, Co. Durham. [8174]

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LANCASHIRE AIRCRAFT CORPORATION, Ltd., Bovingdon Airport, Herts, require qualified pilots, navigators and radio officers for their York fleet. Only applicants holding appropriate M.C.A. licences will be considered.—Please write full details to the Personnel Manager at above address. [0090]

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TECHNICAL illustrators, senior and junior, required by Hawker Aircraft, Ltd., Kingston-on-Thames, Surrey. Seniors should be from about 25-30 years with 4 years' illustrative experience, preferably on Ministry publications. Good pay, facilities and superannuation.—Apply fully to Personnel Supervisor. [8170]

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APPLY, Crewair Engineering, Ltd., Southend Airport, Southend-on-Sea, Essex. Phone: Rochford 50466. [8173]

THE Aircraft Division of the English Electric Co., Ltd., have vacancies at Warton, near Blackpool, for draughtsmen with experience on the installation of armaments in aircraft.—Please write, giving full details of qualifications and experience and quoting reference "English Electric 1EL," to Westminster Employment Exchange, Chadwick Street, S.W.1. [8167]

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APPLICATIONS are invited from senior and intermediate design draughtsmen. Experience of aero-engine design desirable, but not essential. Also checkers. —Please write, stating age and giving details of previous experience in chronological order to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [8030]

CHIEF test engineer required by large firm, S.E. England, for aeronautical division, with good technical education to B.Sc. standard. Practical experience of production problems connected with radar, hydraulic servos and electronic servos in the aircraft industry. Progressive post, pension scheme.—Write fully, stating age, experience, to Box F.221 at 191, Gresham House, E.C.2. [8118]

DESIGN engineer required by the Aircraft Division of the English Electric Co., Ltd., for work on a supersonic wind tunnel at Warton, near Blackpool. Applicants should be of at least Higher National Certificate standard and experience of this type of work is desired.—Please write, giving full details and quoting ref. 9052, to Central Personnel Services, English Electric Co., Ltd., 24-30 Gillingham Street, London, S.W.1. [8047]

APPLICATIONS are invited from design draughtsmen and stressmen also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.—Applications should state full particulars of experience and qualifications and should be addressed to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [8032]

GRADUATE in aeronautical or mechanical engineering is required for work concerned with stress calculations on mechanisms, gear trains and dynamically loaded light alloy structures, in an experimental research team at Stanmore.—Apply to the Staff Manager (Ref. GBL/C8.20), Research Laboratories of The General Electric Co., Ltd., Wembley, Middlesex, stating age, experience or qualifications. [8146]

HANDLEY PAGE (Reading), Ltd., The Aerodrome, Woodley, Reading, have vacancies in their design office for senior aircraft draughtsmen both electrical and airframe, also for a weights engineer with at least two years' experience. These positions are progressive and offer good scope for advancement to the right men.—Please send full particulars to The Personnel Officer or apply through your Local Employment Exchange. [8074]

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THE SUPERMARINE WORKS of Vickers-Armstrongs, Ltd., have vacancies in their Publications Department in connection with the preparation of aircraft instruction manuals. Applicants should have experience in either (1) Perspective and workshop drawing, or (2) Compilation of articles of a technical nature. Experience on R.N. or R.A.F. aircraft maintenance an advantage.—Write, giving full details of experience and salary required, to Personnel Department, Vickers-Armstrongs, Ltd., Hursley Park, Nr. Winchester, Hants. [8153]

BRITISH EUROPEAN AIRWAYS require a technical assistant in the Aircraft Maintenance Branch, Head Office, Ruislip. Candidates should have served apprenticeship in aircraft industry with subsequent production experience and possess Higher National Certificate or equivalent in mechanical or production engineering. Initiative, ability to undertake special investigations and a strong personality are essential. Salary scale £670 to £950 per annum.—Written applications, stating age and qualifications to Personnel Manager, B.E.A., Keyline House, Ruislip, Middlesex. [8163]

BRITISH OVERSEAS AIRWAYS CORPORATION have vacancies for engineer officer (flight engineers). Applicants must be between 21 and 35 years of age, of a high standard of physical fitness and educated to matriculation or equivalent standard. A sound engineering background and training is essential and only those with a Maintenance Engineer's Licence endorsed in categories "A" and "C" (preferably on modern four-engined aircraft) will be considered. Successful applicants will be appointed for a probationary period while undergoing training. Salary for qualified men commences at £720 per annum, rising to a maximum of £1,245 per annum, plus certain allowances payable whilst on service.
APPLICATION should be addressed to Chief Personnel Officer, B.O.A.C., Airways House, Great West Road, Brentford, Middlesex. [8179]

APPLICATIONS are invited by the Ministry of Supply for an appointment in the grade of principal scientific officer to take charge of two new low-speed wind tunnels at an Establishment in Bedfordshire. Responsibilities include the development of experimental technique, the detailed operation of the tunnels and the analysis of test results. Applicants must be at least 31 years of age and possess a 1st or 2nd class honours degree in engineering, physics or mathematics. Considerable experience in experimental aerodynamics, including wind tunnel work is essential. Salary will be assessed according to age, qualifications and experience within the inclusive range £1,035 to £1,377 male. Rates for women are somewhat lower. Post is unestablished but carries benefits of F.S.S.U. A house will be available for the successful applicant if married.—Application forms obtainable from Technical and Scientific Register (K), Almack House, 26-28, King Street, London, S.W.1, quoting C.303/52A. [8181]

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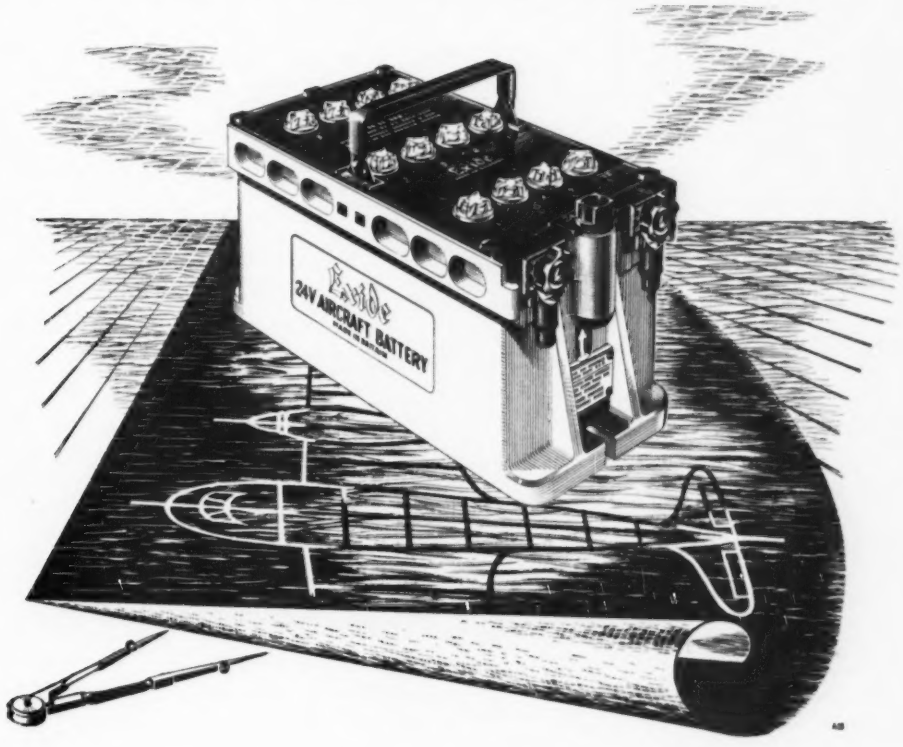

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